U

NOV 1940

BULLETIN

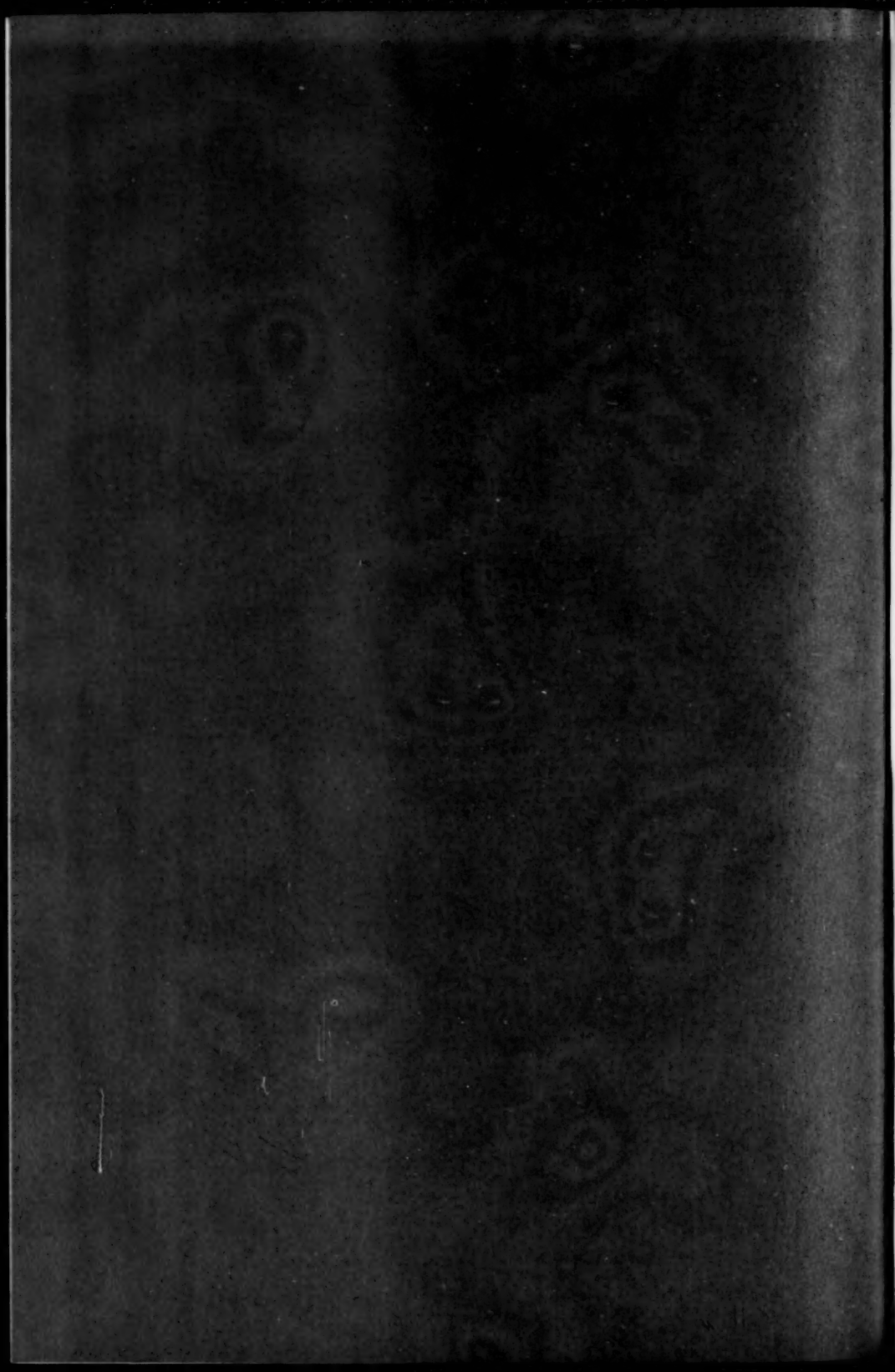
OF THE NEW YORK ACADEMY OF MEDICINE

Original Articles

by

J. WILLIAM HINTON
CHARLES W. LESTER
ROBERT T. FRANK
WARNICK J. KERNAN
WILLIAM HALL LEWIS, JR.

THE STEERING COMMITTEE AND ACADEMY FINANCING



SECOND SERIES NOVEMBER 1941 VOL. 17, NO. 11

BULLETIN OF THE NEW YORK ACADEMY OF MEDICINE

CONTENTS

The Steering Committee and Academy Financing . . 825

Carcinoma of the Stomach Emphasizing Some of the Misconceptions of the Disease 829
J. William Hinton

Acute Surgical Conditions of the Abdomen in Children 844
Charles W. Lester

Treatment of Disorders of the Menopause 854
Robert T. Frank

Medical Testimony in Personal Injury Action . . . 864
Warnick J. Kernan

The Evolution of Clinical Sphygmomanometry . . . 871
William Hall Lewis, Jr.

Library Notes:

Recent Accessions 882

AUTHORS ALONE ARE RESPONSIBLE FOR OPINIONS EXPRESSED IN THEIR CONTRIBUTIONS

Published monthly by THE NEW YORK ACADEMY OF MEDICINE
2 East 103 Street, New York

Entered as second-class matter, February 3, 1928, at the Post Office at New York, N. Y., under the Act of August 24, 1912. Subscription, United States, Canada and Cuba, $3.00; all other countries, $4.00 a year. Single copies, 50c.

OFFICERS AND STAFF OF THE ACADEMY

1941

President

MALCOLM GOODRIDGE

Vice-Presidents

RUFUS I. COLE — I. OGDEN WOODRUFF — HENRY CAVE

Treasurer — BERNARD SACHS

Assistant Treasurer — RODERICK V. GRACE

Recording Secretary — JAMES RALPH SCOTT

Trustees

GEORGE BAEHR
ARTHUR F. CHACE
CARL EGGERS
*MALCOLM GOODRIDGE
SHEPARD KRECH
JAMES ALEXANDER MILLER
HAROLD R. MIXSELL
WALTER L. NILES
EUGENE H. POOL
*BERNARD SACHS
*JAMES RALPH SCOTT
FREDERIC E. SONDERN
CHARLES F. TENNEY

Council

The President — The Vice-Presidents — The Trustees
The Treasurer — The Recording Secretary
The Chairmen of Standing Committees

Director

HERBERT B. WILCOX

Librarian

ARCHIBALD MALLOCH

Executive Secretary
Public Health Relations Committee
E. H. L. CORWIN

Executive Secretary
Committee on Medical Education
MAHLON ASHFORD

Executive Secretary, Committee on Medical Information
IAGO GALDSTON

Library Consultants

LAURA E. SMITH — B. W. WEINBERGER — ARNOLD C. KLEBS

Legal Counsel
FRANK L. POLK, ESQ.

EDITORIAL BOARD

JEROME P. WEBSTER, *Chairman*

ALFRED E. COHN — ROBERT F. LOEB — PHILIP VAN INGEN
EUGENE F. DUBOIS — ARCHIBALD MALLOCH — KARL VOGEL
MAHLON ASHFORD, *Editor*

* Ex-officio

BULLETIN OF
THE NEW YORK ACADEMY
OF MEDICINE

NOVEMBER 1941

THE STEERING COMMITTEE AND ACADEMY FINANCING*

WHEN the Budget Committee of the Academy meets, the specter of a deficit will be absent for the first time in several years. This does not mean that the Committee can relax its vigilance, or even grant the various departments all the funds they request, but it does mean that the financial tension has temporarily eased and the Academy program for the ensuing year can be planned in orderly fashion.

For nearly a decade the Trustees have faced a financial dilemma. Confronting a tremendous increase in the demands on Academy services was the inescapable reality of steadily declining revenue from the capital funds. Income from sources such as dues and assessments of organizations having headquarters space within the building is virtually stationary and can not be expected to gain appreciably in any one year. The situation resolved itself into an annual reduction of the budgetary requests of the various departments even to the extent of crippling their activities.

Late in 1936 the Academy approached the new year with the prospect of having its 1937 budget off-balance in the sum of $30,000. A fund-raising committee was formed which succeeded in raising $23,216.50 that year among Fellows of the Academy and a few lay

* Progress Report to the Academy Fellowship from the Committee, Sept. 10, 1941.

friends. With this money and by the exercise of rigorous economies the deficit was changed into a small favorable balance.

At the beginning of 1938 a deficit of $33,000 was anticipated. Through strenuous efforts the Fund-Raising Committee succeeded in raising $29,100.16.

As many of the 1937 and 1938 contributions were made with the stipulation that renewals could not be expected, the Trustees realized that the annually recurring financial problem was being met only temporarily. It was obviously time to take stock.

In May of 1939 the Council appointed a Steering Committee with Dr. Harold R. Mixsell as chairman to study Academy finances and make recommendations looking toward abolition of the hand-to-mouth existence. Associated with Dr. Mixsell were: Doctors Shepard Krech, Robert L. Levy, Walter L. Niles, William Barclay Parsons and Charles F. Tenney, with the President and Director serving ex-officio. The Fund-Raising Committee, after completion of its task, was replaced by the Steering Committee and turned in $10,047.50. At the close of 1939 the Academy had a substantial deficit. Then one of those things happened which you hear about but are slow to believe. In his annual address on January 4, 1940, President Malcolm Goodridge reviewed the Academy's financial picture including the announcement that the Academy was entering the new year with a deficit. The following day Mr. Bernard M. Baruch read an account of Dr. Goodridge's address in a New York newspaper and later dispatched his personal check for $18,000 to cover the full amount, thus enabling the Academy to start the year with a clean slate.

After mature consideration the Steering Committee decided in 1940 to engage professional counsel in planning the Academy's finances. Under their guidance a lay council was formed as an auxiliary to the Steering Committee. Men prominent in the city's business and industrial life were invited to the Academy individually to meet with officers and members of the Steering Committee. Most of them knew little or nothing about the Academy, the services it renders the medical profession and the public, and its potentialities for greater usefulness. With only a few exceptions they enthusiastically agreed to serve. Therein the Committee learned a valuable lesson. They found that the Academy could have numerous influential friends outside the profession by carefully presenting its case, and making known that lay support was welcome.

The Lay Council as originally organized consisted of Walter S. Gifford, chairman, Arthur M. Anderson, George Blumenthal, Lewis H. Brown, Clinton H. Crane, Marshall Field, Joseph M. Hartfield, David M. Heyman, Philip W. Lennen, George W. Merck, and Edward L. Shea. W. Gibson Carey, Jr., has replaced George Blumenthal since deceased.

Meantime the Steering Committee had been enlarged to include the following Fellows: Doctors George Baehr, Henry W. Cave, Arthur F. Chace, John Staige Davis, James Alexander Miller, Alfred T. Osgood and Carnes Weeks.

Jointly the Steering Committee and the Lay Council worked out a plan to take care of the Academy's more pressing needs for the next five years. This called for the raising of $550,000. Of that sum $250,000 or $50,000 a year was to be set aside for budgetary purposes. The balance or $300,000 was to be spent for new stack floors and catalogue rooms of the library which for many years had been handicapped by inadequate space with stack floors filled to almost 100 per cent capacity.

Naturally some dissension was heard. "This isn't the time," "England needs all we can spare," "Don't build now," were a few of the comments. But the Steering Committee, backed by the Council and Trustees, knew that there were only two choices: either go ahead or sharply curtail Academy activities. In the decision to go ahead they were supported by the Lay Council. One internationally-known industrialist advised: "We know what we have now; we don't know about the future."

It was decided to avoid the usual campaign machinery and also any direct appeal to the Fellowship as a whole. It was felt that in the main the Fellows through their initiation fees, annual dues, and gifts during the campaign of the Fund-Raising Committee in the late 1930's had done about all that could reasonably be expected. Instead, interest was centered in philanthropically inclined citizens, smaller foundations, known to be favorably disposed toward the advancement of medicine, and certain commercial companies which have long profited from the Academy's existence. Members of the Lay Council proved invaluable in providing contacts with these groups.

The Steering Committee held 36 weekly meetings between October 1940 and September 15 of this year with an average attendance of 70 per cent. The Lay Council was assembled only twice as a full body,

these being dinner meetings, but there have been innumerable individual conferences between members of the Steering Committee and members of the Lay Council.

Now the Steering Committee is happy to report to the Fellowship that the five-year plan appears reasonably certain of fulfillment. The Committee has raised in cash gifts or pledges $181,519. It does not intend to stop work until the full amount is subscribed.

That is why Budget Committee members will have smoother brows when they take up their task this month. They have visual evidence that the combination of Steering Committee and Lay Council works, and are confident it will be 100 per cent successful.

Although it is pleasing to contemplate the prospect of balanced budgets during the stormy years ahead, the Trustees realize that this, too, may be only a longer stop-gap. For the last several administrations, presidents of the Academy have stressed the importance of increasing the endowment. Only this, it is believed, will place the institution on a sound basis.

In February, 1940, the Trustees charged the Steering Committee with the responsibility of placing the Academy on a sound financial basis. Under their leadership it is hoped to add $1,000,000 to endowment, giving the Academy a total of $4,000,000 in capital funds. As a matter of fact, a total of $5,000,000 is needed for real security. Neither the Trustees nor the Steering Committee have any illusions about the magnitude of this responsibility. It is their sincere hope that all the Fellows of the Academy who prize their fellowship will assist in the undertaking. With such collaboration the $5,000,000 ultimate goal can be reached within the next two years and the Academy put on firm financial footing before reaching its one-hundredth anniversary.

CARCINOMA OF THE STOMACH EMPHASIZING SOME OF THE MISCONCEPTIONS OF THE DISEASE*

J. WILLIAM HINTON

Associate Clinical Professor of Surgery
New York Post-Graduate Medical School, Columbia University

In the evaluation of any disease one should try to determine if the disease is frequently encountered by the medical profession or is a disease only encountered in the large medical centers. For that reason carcinoma of the stomach should be emphasized as to its frequency in relation to carcinoma of other organs and as a cause of death as related to other diseases. The causes of death in the United States for 1938 as reported by the United States Bureau of the Census is given in Table I. From this report one sees that carcinoma is second only to heart disease as a cause of death. Now carcinoma of the stomach causes one-fifth of the deaths of carcinoma patients. Livingston and Pack[1] state that one-fourth to one-third of the deaths of carcinoma patients are due to stomach carcinoma. The error of their report is that they have included the liver and biliary tract carcinoma with the stomach cases. The Metropolitan Life Insurance Company reporting on carcinoma among their policy holders over a 25-year period, 1911-1935 inclusive, found that 32 per cent died from carcinoma of the stomach and liver. From 1917 they have separate records of carcinoma of the stomach, and the biliary tract. During this period 20.4 per cent died from carcinoma of the stomach and 8.7 per cent from carcinoma of the liver and biliary tract. Carcinoma of the female genital organs was second in importance and caused 20.1 per cent of carcinoma deaths. Carcinoma of the intestines, rectum, and anus was third and caused 13.6 per cent of the total carcinoma deaths. Carcinoma of the breast was fourth with 6.7 per cent.

One should consider what percentage of deaths of the total population are due to carcinoma of the stomach. The Metropolitan figures give 2.6 per cent when including the liver and biliary tract cases, and

* The Friday Afternoon Lecture of The New York Academy of Medicine of December 13, 1940.

TABLE I

ANALYSIS OF CAUSES OF DEATHS IN THE UNITED STATES IN 1938
(Source: Special Reports. United States Bureau of the Census)

	Deaths
Diseases of the heart	350,168
Cancer and other malignant tumors	149,214
Cerebral hemorrhage, cerebral embolism and thrombosis	111,567
Nephritis, acute and chronic	100,520
Accidental, other or undefined	93,805
Pneumonia, all forms	87,923
Tuberculosis, all forms	63,735
Diabetes mellitus	31,037
Arteriosclerosis (except coronary arteries)	21,208
Suicide	19,802

1.8 per cent when the stomach alone is considered. This latter figure is accurate by comparison with the figures from Bellevue Hospital. We found among 1,040,784 admissions 1.7 per cent were suffering from carcinoma of the stomach. The Metropolitan figures cover all ages, and our figures, all admissions including pediatrics, obstetrics, psychiatry and neurology.

WHAT DOES THE FUTURE OFFER TO ONE SUFFERING FROM CARCINOMA OF THE STOMACH?

Livingston and Pack[1] in their most comprehensive review have reported 14,475 cases of gastric carcinoma from the world literature with 2,861 resections of the stomach, or a resectability of 18.7 per cent. From these figures one would be very favorably impressed as to the chance of removal of the growth, which is approximately 1 in 5. Before accepting this as being the real percentage one must remember that their report includes the large medical centers of the world and in no way includes the patients in private practice who never enter a hospital or clinic, nor does it include the small hospitals of the country. For that reason we undertook to review the cases of carcinoma of the stomach admitted to the Fourth Division at Bellevue Hospital for a 20 year period, and we have reported on these findings.[2] It was our feeling that

TABLE II

BELLEVUE SERIES

Relation of Operability to Duration of Symptoms

Duration	Number	Non-operable	Operable	Resection*
Less than 1 month	62	41	21	3
1-3 months	82	65	17	5
3-6 months	82	57	25	5
6-12 months	70	45	25	5
1-2 years	65	43	22	3
2-3 years	19	15	4	1
3-5 years	15	10	5	1
5-10 years	15	12	3	1
Over 10 years	4	2	2	
Unknown	30	6	24	
Total	444	296	148	24

* The figures in this column are included under operable.

the ward service of a large municipal hospital would more nearly represent the true picture of the disease for the country than reports from clinic and medical centers which received referred cases. The cases entering large medical centers, having been selected by the family physician, would give a false sense of optimism for the disease. In studying 444 carcinomas of the stomach we found two-thirds, or 296, inoperable on admission. Of the 148 operable cases only 24 were resectable or 5.4 per cent of the total admissions.

The point that is always stressed in discussing carcinoma of the stomach is the importance of making an early diagnosis. It is worth emphasizing some of the reasons why an early diagnosis is not made. In our Bellevue study we were amazed at one finding, namely, the patient with symptoms of one month's duration has no better chance of removal of the growth than one with symptoms of one year's duration. These findings are illustrated in Table II. It occurred to us that cases from another hospital would not confirm this observation. Therefore, the ward cases admitted to Post-Graduate Hospital for the past 20 years have been reviewed and are being reported.[3] We excluded any ward

TABLE III

POST-GRADUATE SERIES

Relation of Operability to Duration of Symptoms

Duration	Number	Non-operable	Operable	Resection
Less than 1 month	11	4	5	2
1-3 months	33	4	22	7
3-6 months	48	17	24	7
6-12 months	48	11	25	12
1-2 years	24	5	9	10
2-3 years	12	2	5	5
3-5 years	6	1	2	3
5-10 years	5	...	4	1
Over 10 years	3	...	1	2
Unknown	6	1	4	1
Total	196	45	101	50

case admitted from an Attending Physician's office and accepted only the service cases. There were 196 cases and Table III gives the findings for the group. The percentage of resections for the total group was 25.5 per cent, but of forty-four patients with symptoms of not over 3 months' duration only nine were resectable, which is only 20.4 per cent resectability.

WHY IS IT DIFFICULT TO DIAGNOSE CARCINOMA OF THE STOMACH EARLY WHEN WE HAVE SO MANY REFINEMENTS IN DIAGNOSTIC METHODS?

It is difficult for the pathologist to diagnose carcinoma of the stomach from an ulcer of the stomach. There are two schools of thought on the point as to whether a gastric ulcer becomes malignant. During the past three decades the percentage has ranged from 70 per cent for some pathologists to 1 per cent for others. This fundamental point is very important as the advice given a patient with a gastric ulcer hinges on this basic concept of the disease.

If a high percentage of gastric ulcers develop malignant degeneration, then immediate operation should be recommended with the risks

attended by such a procedure. Schindler[4] in a very recent article has discussed this point and, to quote:

"For a long time the opinion was prevalent that many gastric carcinomas develop on the soil of benign ulcers." This opinion, however, is now almost untenable. Walter Lincoln Palmer contends: "that the existence of carcinomatous degeneration in benign ulcer remains to be proved conclusively. Gastroenterologists who carefully watch their ulcer patients over a period of several decades have never seen such an ulcer develop into a carcinoma. Peptic ulceration of carcinoma may produce a lesion grossly indistinguishable from benign ulcer. Indeed, there is evidence that the carcinoma may be completely digested away by peptic activity, leaving a typical benign ulcer. Probably a carcinomatous ulcer is malignant from the beginning."

In the stomach clinic of the Fourth Division at Bellevue Hospital we have taken the same stand and now have had 13 years of experience without cause for regret. In 1937 we published[5] our results on gastric ulcer and gastric carcinoma. We wish to emphasize at this time that, if there is the slightest doubt in the differential diagnosis of a gastric ulcer from gastric carcinoma, the patient should be advised to have an immediate operation so as to eliminate this possible error. This debatable point will never be settled until a central bureau for registering all five-year cures of carcinoma of the stomach has been established, in that way eliminating any skepticism of the five-year cures being due to inflammatory lesions instead of a true neoplasm. The following case will illustrate the state of confusion as to classification by competent pathologists.

A male, 38 years of age, was seen March 1939 complaining of vague stomach symptoms and vomiting. X-rays of the gastrointestinal tract were negative in July of 1938. In January 1939 they were repeated at the same hospital and found to reveal a deformity of the pylorus which was considered carcinoma. A re-check of the x-rays at Post-Graduate Hospital confirmed the findings of carcinoma of the pyloric end of the stomach. At operation on March 11, 1939 a lesion was found on the lesser curvature 1 inch from the duodenum, and clinically it was impossible to state whether the lesion was an ulcer or carcinoma, but a subtotal resection was done and some lymph glands were encountered in the gastrohepatic omentum around the pylorus. The sections of lymph glands were negative for a metastatic carcinoma. To quote the pathological findings:

"The question of malignancy in this case is rather difficult to decide, because the changes are not clear cut. It was my opinion at first that the changes in the glands could be interpreted as atypical regeneration of epithelium in a healing ulcer. However, the slides were shown to several other pathologists, whose opinions are given below:"

Three are inclined to regard the lesion as not malignant. One has seen similar glands in a case of syphilitic ulcer of the stomach.

Three regarded the lesion as malignant. One calls attention to the superficial nature of the ulcer, and thinks that only a malignant condition would cause this and lead to symptoms warranting operation. He feels that the lesion was malignant from the beginning and he is pessimistic as to the outcome.

Two consider the malignancy as an early one, and give more favorable prognosis.

Final diagnosis: "In view of the above opinions, it is better to consider this case as one of carcinoma of the stomach."

Schindler[4] has given Borrmann's macroscopic classification of gastric carcinoma, which should be of aid to the surgeon, and he describes four types of growth. Schindler, following Borrmann, divides them as follows:

"The first gross type of gastric carcinoma is the polypoid carcinoma. This is a sharply limited growth often looking like a mushroom with overhanging edge, its surface presenting numerous nodes and nodules which usually are of different sizes. Only at a very late stage will ulceration of this surface develop. The mucosa surrounding this type of tumor is often thoroughly atrophic. This type is not a frequent one. According to my own statistics it is found in 2.9 per cent of all gastric carcinomas, if carcinoma of the cardia is omitted. In my experience this type grows slowly and, it seems, never changes into another type, but remains polypoid and sharply limited. Microscopically most tumors of this group are well differentiated adenocarcinoma, and it seems that here radical operation at not too late a stage gives very good prognosis.

"Type 2 is a very important form. It is found rather infrequently, namely 17.6 per cent of all cases. It is an ulcer surrounded by an elevated wall. This wall has a steep slope toward the surrounding mucosa and is sharply demarcated all around against the surrounding mucosa. The floor sometimes shows necrotic material of all colors—brown, purple, gray, dark red or white. Sometimes necrotic, gray white crystal-

like excrescences can be seen floating in the current of air introduced during examination. The wall may be smooth or, more frequently, is nodular and contains shallow erosions. Its dark red color, then, is in marked contrast to the pale color of the surrounding mucosa. Since the surgeon tries to operate as soon as possible on these tumors he rarely has the opportunity to watch gastroscopically their course over a long period of time, but sometimes the patient may refuse the immediate operation and then such an observation may become possible. Within one week the thickness of the wall may double. However, I have never seen this sharply limited wall become diffusely infiltrative at a later stage. The number of such observations is naturally still too small to permit the definite statement that such a transition is never possible. The observation, nevertheless, is an amazing one because the microscopic structure of these carcinomas is not a uniform one. They often show little differentiation and look rather malignant microscopically.

"The startling point about these type 2 carcinomas is that metastases develop at a relatively late stage and often lead to an extremely satisfactory end result, to cures of long duration if an operation can be performed at not too late a moment, whatever their microscopic structure may be. These are the well-known tumors which may reach the size of a fist, which can well be palpated through the abdominal wall and which are definitely movable. This is the form of carcinoma which at x-ray examination frequently gives the so-called meniscus sign of Carman. . . .

"In the type 3 carcinoma of Borrmann an ulceration is found also. This ulceration has a wall, but the wall is found only at one side of the ulcer and does not slope as steeply as does the wall of the type 2 carcinoma. There is a more gradual transition, and the ulcer itself, although sharply limited at one side, blends diffusely at the other side, and there, diffuse and progressive infiltration of the neighboring mucosa is seen. This type 3 carcinoma occurs in 16.3 per cent of all cases. Here again the microscopic pictures are not typical at all.

"The type 4 of Borrmann is the diffuse infiltrating type, which unfortunately occurs in 63.2 per cent of the cases. No sharp limit will be found anywhere toward the normal gastric mucosa either with the eye or by palpation; sometimes the entire stomach may be infiltrated. In this case, in which the stiff nodular infiltration is seen, the entire

stomach was found gastroscopically to be involved at the very first observation, almost two years before the patient died. Within this infiltration, ulceration may develop—shallow ulcers or deep ones. They never show the sharp edge of the typical benign ulcer. These type 4 carcinomas seem to be not very favorable tumors. I have never seen a complete cure after the resection of such a tumor, but naturally the material is too limited to permit any definite conclusions."

With the divergent views on carcinoma of the stomach the natural question arises as to how the diagnosis can be made. In our reviews from Bellevue Hospital and Post-Graduate Hospital we found the following symptoms as listed in Tables IV and V.

The first diagnostic procedure is a gastrointestinal x-ray series. This properly done will diagnose 95 per cent of the carcinomas of the stomach. One must remember that a very early carcinoma may not be discovered and a few weeks later, due to its rapid growth, the diagnosis is easily made. This type of case offers a hopeless prognosis even if an early diagnosis is made.

The gastroscope is now of indispensable service in establishing the diagnosis of carcinoma of the stomach. A word of warning is that the gastroscopist must have had considerable experience to be of real value in these cases. If the gastrointestinal x-ray series is negative and the age or symptomatology suggests carcinoma of the stomach, a gastroscopy should always be performed.

Gastric analysis: This procedure should not be overlooked and in cases with stomach symptoms presenting a low free hydrochloric acid, a gastrointestinal x-ray series should be ordered. If the x-ray examination is negative and the symptoms persist with a low free hydrochloric acid finding, a second gastrointestinal x-ray series should be ordered after a few weeks. In from 15 to 20 per cent of carcinomas of the stomach the free hydrochloric acid will be in normal limits, which should be remembered in the differential diagnosis between an ulcer and carcinoma of the stomach. The presence of blood in the gastric analysis is of importance, as between 50 and 65 per cent of the carcinomas of the stomach have blood, while the incidence of blood in ulcer of the stomach is lower, which is explainable in the size of the two lesions.

The determination of the cholesterol content of the urine is another laboratory procedure worth considering. Bruger[6] has found that patients

TABLE IV

BELLEVUE SERIES
Presenting Symptoms in Order of Frequency

Symptom	Number	Percentage
Pain	412	92.8
Loss of weight	398	89.6
Weakness	269	60.5
Cachexia	195	43.7
Jaundice	103	23.2
Nausea or vomiting	73	16.3
Hematemesis	41	9.2

TABLE V

POST-GRADUATE SERIES
Presenting Symptoms in Order of Frequency

Symptom	Number	Percentage
Pain	154	76.2
Loss of weight	145	71.8
Nausea or vomiting	121	59.9
Anorexia	64	31.7
Weakness	55	27.2
Cachexia	45	22.3
Jaundice	7	3.5
Hematemesis	7	3.5

with carcinoma of the gastrointestinal tract may eliminate in the urine as high as 40 mg. of cholesterol in 24 hours, while a normal person does not eliminate over 2 mg. in 24 hours. The amount of cholesterol eliminated is highest in the early stages of the disease.

THE SURGICAL MORTALITY AND FOLLOW-UP OF CARCINOMA OF THE STOMACH

Livingston and Pack[1] in reporting on the mortality since 1920, re-

port 3,127 cases of gastric resection with a 22 per cent mortality. These figures are from the large clinics and represent the most favorable picture. The follow-up as given by them for 3-year cures is 29 per cent; 5-year cures, 19 per cent; 10-year cures, 10 per cent. These figures are largely based on the cases traced, which is always misleading and gives a much higher percentage of cures because the dead cannot reply and the relatives are not interested in replying to follow-ups. Then of 100 carcinomas of the stomach receiving the best surgical treatment in the large clinics, 18.7 per cent can be resected and of those that are resectable there will be a 22 per cent mortality. Of the patients leaving the hospital 19 per cent are alive after 5 years, which means in 100 cases of carcinoma of the stomach only 2.8 per cent will survive 5 years after the best surgical care.

There is nothing that offers a cure except radical surgery, but the future of this important disease does not lie in the repetition of early diagnosis and radical surgery, because very little has been accomplished in the past two decades from this teaching, if the questionable gastric ulcers are eliminated from the follow-up reports. One fact about carcinoma of the stomach is that it attacks men in the ratio 3 to 1 as compared to women.

Carcinogenesis as It Relates to Carcinoma of the Stomach

In a recent report[2] of statistical and diagnostic data on cases of carcinoma of the stomach, their discouraging status was emphasized. The magnitude and seriousness of this problem is realized when one is confronted with a condition that accounts for one-fifth of the total carcinomatous deaths annually. That has led us to review the experimental work on carcinogenesis with the hope it might throw some light on this serious problem. For complete details on this review you are referred to the original article of Abrahamson and Hinton.[7]

Over 88 per cent of the cases of carcinoma of the stomach fall between the ages of 35 to 70 with the peak of incidence occurring in males between 50 and 55, and females between 55 and 60. The age incidence and sex discrepancy in gastric carcinoma are two facts which stand out in almost every large series reported in recent years, Balfour and Hargis,[8] Smithies,[9] Friedenwald,[10] Masson,[11] Minnes and Geschickter.[12]

Many authors, largely physiologists and experimental workers, have

definitely proved the production of malignant growths in animals, by the injection and application of estrogenic substances. The carcinogenic effect of estrogenic hormones on tumor formations, have been shown to be both actual and definite by repeated experiments. Flacks and Ber,[13] after producing cutaneous tumors in mice by the action of methyl-cholanthrene, found that the percentage of tumors was less when they were previously injected with testosterone propionate.

The close relationship between the chemical structure and biological properties of many highly carcinogenic substances and that of the estrogenic and androgenic hormones, has recently been demonstrated. The highly carcinogenic activity of hydrocarbons, such as methylcholanthrene and its derivatives, have been confirmed in several laboratories. It has been shown that certain estrogens and other normally found substances, via their sterol radicals, can be demonstrated to have an "inherent tendency" to pass into such high carcinogenic substances as methylcholanthrene and its derivatives (Rossner,[14] Barry, Cook et al,[15] Shear,[16] Cook and Dodds,[17] Flacks and Ber[13]). These findings have been well summarized in recent reviews by Cook[18] and Needham.[19]

Experimental work with the injection of carcinogenic agents into various tissues, has shown that tumors develop more readily in some than others. A species difference has also been noted. Certain cells within the organism are more susceptible to neoplastic transformation than others under equal contact with carcinogenic agents. However, it has also been noted that the response of a given tissue to a carcinogenic agent is specific for both cell and type of carcinogenic agent, and has no relationship to spontaneous tumor formation. Rusch, Baumann and Maison[20] injected the submucosal layers of the stomach of rats with benzypyrene in three cases and caused the formation of myoma, spindle cell sarcoma and adenocarcinoma of the stomach. Similar injection of the duodenum did not cause tumor formation.

Stewart,[21] although causing the formation of gastric adenocarcinoma in four mice by the injection of methylcholanthrene into the muscular tissues of the stomach wall, believed that the gastric mucosa is relatively resistant to the action of methylcholanthrene. In this connection, the work of Perry and Ginzton[22] has importance in that they seem to have broken down the resistance of the mouse stomach to malignancy by combining 1, 2, 5, 6, dibenzanthracene with theelin, thereby causing

gastric malignancies which were not caused by the use of 1, 2, 5, 6 dibenzanthracene alone.

Studies on sterols present in the human blood stream show that several are related to highly carcinogenic substances, not only by chemical formulae and physiological action, but by biophysical and biochemical reactions. They are in themselves carcinogenic in experimental animals, although under ordinary circumstances in the human body, they do not bring about this change.

The inherent tendency however, of some of these sterols to change into carcinogenic substances under chemical physiological circumstances not foreign to human metabolic processes, sheds light on their potentialities (Needham,[19] Cook and Kennaway,[23] Fieser[24]).

It is well known that during that period of life when carcinoma most frequently occurs, there are radical changes in the content and nature of the hormones, specifically the gonadotropic, estrogenic and androgenic hormones, as evidenced by chemical recovery from the organs, blood and urine, and by the involutionary and regressive changes which take place during this period. Estrogenic and androgenic substances have been shown to influence the incidence of carcinoma in experimental animals. It has also been reported that very slight alterations in the chemical structure of estrogenic and androgenic hormones in their proportional relationship to each other, may transform them into active carcinogenic agents (Korenchevsky and Hall[25]).

Since it is our contention that the gastric mucosa acts as a gland of both internal and external secretion, its activities, therefore, are subject to regulation by endocrines produced by glands elsewhere in the body. Since interchange and interactivity of the glands of internal secretion have been demonstrated, it is logical to assume that the activities and secretion of the gastric mucosa should be added to the roster of glands whose functions are interdependent and subject to the carcinogenic effects of other hormones.

Peculiarly, estrogen of all the hormones, has been proved to have carcinogenic activity. It has been shown that in certain instances, androgens are able to retard or prevent the experimental induction of tumor development (Nathanson and Andervont[26]). On the basis of these and similar extensive experimental work on rabbits, and by means of a theoretical chemical study, Murlin et al[27] have concluded that estrogens owe their carcinogenic activity to their necessity for oxida-

tion. Prevention of this action is accomplished by androgens which provide hydrogen acceptors–thus titrating the hydrogen which estrogens have to spare and preventing the derangement of normal cell life. In these experiments, with the exception of testosterone propionate, the effective materials used in the protection against tumor formation and prevention of metastases were urinary extracts and it is quite possible that other unidentified sterols and their related products were present.

Although there can be no question of the carcinogenic activity of estrogens in lower animals, it is certain that the formation, activity and metabolism of hormones vary in different species. These differences have been observed between rats, mice and rabbits and it is very likely that the metabolic processes affecting hormone activity in the human body differ materially from those in animals in which tumor growth was retarded by androgen injection. Although it is well-known that malignant tumors are common in elderly dogs, carcinoma of the stomach is a rarity (Feldman[28]). In 142,000 necropsies in mice, only fifteen spontaneous tumors of the stomach were found. Wells et al[29] have emphasized the striking infrequency of alimentary tract cancer in animals, with the exception of man where over one-half are found in the alimentary canal.

We believe our own statistical and clinical findings agree with animal experiments to indicate that sex hormones affect the incidence of tumor formation. Controversial findings by competent workers are reported, in that both estrogens and androgens have been shown to have protective powers against tumors. Estrogens have been reported both as a carcinogenic substance and as an immunizing agent against tumor inoculation and metastasis. It would seem that the disproportion between these two hormones and other hormones is of greater importance than the activity of either one. However, since it has been determined that hormone effects are the resultant of the algebraic sum of all the endocrine secretions, we believe that several other hormone effects are involved, viz.: pituitary, thyroid, corpus luteum and adrenal hormones. The tumor forming and the tumor protecting effects of androgens and estrogens are not specific direct effects but general and indirect.

We realize that the experimental work mentioned is incomplete; however, the problem of gastric carcinoma is of such tremendous pro-

portions and importance, that we believe many experimental and clinical observations by various workers with sufficient material will be necessary to bring us a correct evaluation of the data referred to, and its true relationship to carcinoma of the stomach.

Conclusions

1. From personal observation during the past 13 years in the Stomach Clinic of the Fourth Division at Bellevue Hospital, where we observed over 1200 ulcers of the stomach and duodenum, it is our feeling that an ulcer rarely if ever becomes a carcinoma of the stomach.
2. In a previous report on the gastric ulcers from our clinic numbering 104 cases we found nine in which a differential diagnosis between ulcer and carcinoma was not possible.
3. Of these nine cases, all were advised immediate operation and eight submitted. Of the eight cases six or 75 per cent were found to be ulcers by the pathological department.
4. The teaching of early diagnosis and immediate operation in carcinoma of the stomach has offered very little as to ultimate cures in this disease during the past two decades.
5. From the evaluation of our statistical data from Bellevue Hospital and Post-Graduate Hospital, the patient with the short history has no better chance of a permanent cure than the one with a long history.
6. The suggestion of a hormone connection between the estrogens, androgens and gastric mucosa as a possible factor in carcinoma of the stomach is based on the review of the recent work by many authors.

REFERENCES

1. Livingston, E. M. and Pack, G. T. ***End-results in the treatment of gastric cancer.*** New York, Hoeber, 1939.
2. Abrahamson, R. H. and Hinton, J. W. Carcinoma of the stomach; review of 444 cases, *Surg., Gynec. & Obst.*, 1940, *71:* 135.
3. Saypol, G. M. and Hinton, J. W. Statistical review of carcinoma of the stomach, *in press.*
4. Schindler, R. Early diagnosis and prognosis of gastric carcinoma, *J.A.M.A.*, 1940, *115:* 1693.
5. Hinton, J. W. and Trabek, M. The transformation of gastric ulcer into gastric carcinoma, *Surg., Gynec. & Obst.*, 1937, *64:* 16.
6. Bruger, M. *Personal communication.* 1940.
7. Abrahamson, R. H. and Hinton, J. W. The gastric mucosa as an endocrine gland with consideration of the age in-

cidence and sex discrepancy in gastric carcinoma, *in press.*

8. Balfour, D. C. and Hargis, R. H. Cancer of the stomach, *Am. J. M. Sc.*, 1927, *173:* 773.
9. Smithies, F. Symptoms and signs of gastric cancer, *J.A.M.A.*, 1915, *64:* 643.
10. Friedenwald, J. A clinical study of 1,000 cases of cancer of the stomach, *Am. J. M. Sc.*, 1914, *148:* 660.
11. Masson, J. C. Cancer of the stomach, *Canad. M. A. J.*, 1921, *11:* 924.
12. Minnes, J. F. and Geschickter, C. F. Some clinical features of carcinoma of the stomach, *Am. J. Cancer,* 1936, *27:* 740.
13. Flacks, J. and Ber, A. Action anti-cancérigène de l'hormone male, *Compt. rend. Soc. de biol.,* 1938, *128:* 506.
14. Rossner, W. Über neue Derivate des Methyl-cholanthrens und über vom Cholesterin abgeleitete heterocyclische Verbindungen, *Ztschr. f. physiol. Chem.,* 1937, *249:* 267.
15. Barry, G., Cook, J. W. *et al.* The production of cancer by pure hydrocarbons, *Proc. Roy. Soc. London,* ser. B, 1935, *117:* 318.
16. Shear, M. J. Studies in carcinogenesis; the production of tumors in mice with hydrocarbons, *Am. J. Cancer,* 1936, *26:* 322.
17. Cook, J. W. and Dodds, E. C. Sex hormones and cancer-producing compounds, *Nature,* 1933, *131:* 205.
18. Cook, J. W. Chemistry and biological properties of carcinogenic substances, *Ergebn. d. Vitamin-u. Hormonforsch.*, 1939, *2:* 213.
19. Needham, J. Developmental physiology, *Am. Rev. Physiol.*, 1939, *1:* 63.
20. Rusch, H. P., Baumann, C. A. and Maison, G. L. Production of internal tumors with chemical carcinogens, *Arch. Path.*, 1940, *29:* 8.
21. Stewart, H. L. Induction of gastric tumors in strain A mice by methyl-cholanthrene, *Arch. Path.*, 1940, *29:* 153.
22. Perry, I. H. and Ginzton, L. L. The development of tumors in female mice treated with 1, 2, 6 dibenzanthracene and theelin, *Am. J. Cancer,* 1937, *29:* 680.
23. Cook, J. W. and Kennaway, E. L. Chemical compounds as carcinogenic agents, *Am. J. Cancer,* 1938, *33:* 50.
24. Fieser, L. F. Carcinogenic activity, structure and chemical reactivity of polynuclear aromatic hydrocarbons, *Am. J. Cancer,* 1938, *34:* 37.
25. Korenchevsky, V. and Hall, K. Metaplasia and adenoma-like changes in the uterus of rats injected with sex hormones, *Nature,* 1939, *144:* 1048.
26. Nathanson, I. T. and Andervont, H. B. Effect of testosterone propionate on development and growth of mammary carcinoma in female mice, *Proc. Soc. Exper. Biol. & Med.,* 1939, *40:* 421.
27. Murlin, J. R. *et al.* Influence of the androgens on the growth and metastasis of the Brown-Pearce epithelioma, *Arch. Path.*, 1939, *28:* 777.
28. Feldman, W. H. *Neoplasms of domesticated animals.* Philadelphia, Saunders, 1932, p. 308.
29. Wells, H. G. *et al.* Comparative pathology of cancer of the alimentary canal, with report of cases in mice, *Am. J. Cancer,* 1938, *33:* 223.

ACUTE SURGICAL CONDITIONS OF THE ABDOMEN IN CHILDREN*

CHARLES W. LESTER

Associate Surgeon, Bellevue Hospital

THE acute abdominal conditions in childhood differ materially from those of adult life as regards type of lesion, diagnosis and treatment. We have made a study of these abdominal conditions as they have appeared on the Children's Surgical Service of Bellevue Hospital, to which are admitted children up to the age of thirteen. The lesions may be divided into obstructive lesions and inflammations.

Congenital obstructions of the gastrointestinal tract are about the first to be brought to the attention of the surgeon and those of the upper part are the best known. The most common of these is congenital pyloric stenosis which has to be differentiated from the various types of duodenal obstruction.

The symptoms of upper gastrointestinal obstruction are typical. Vomiting begins early and soon becomes projectile in type. There is great distention in the upper part of the abdomen to correspond to the dilated stomach. Peristaltic waves can be seen and the bowels do not move. Because the baby is unable to retain any feedings he rapidly becomes dehydrated and emaciated.

In congenital pyloric stenosis the obstruction is due to the hypertrophied pyloric muscle which is sufficiently large to make a tumor palpable through the abdominal wall. The obstruction is not complete at first and does not become so until spasm develops in the pylorus. This happens usually about two weeks after birth, but may be earlier or later.

Duodenal obstruction may be of two types. The first is intrinsic due to a failure of the duodenal lumen to open properly and it may be a complete atresia from a plug of cells or from a diaphragm; or it may be a stenosis with a tiny lumen. The second is extrinsic and is associated with incomplete rotation of the gut producing obstructive bands or volvulus.

* From the Children's Surgical Service, Bellevue Hospital, Fenwick Beekman, Surgeon-in-charge. Given December 6, 1940 before the Section of Surgery of The New York Academy of Medicine.

The difference in pathology will establish the differential diagnosis between the upper abdominal obstructions. The vomiting of pyloric stenosis usually does not begin until after the second week of life, i.e., when the pylorus closes, although one of our patients developed symptoms on the day after his birth and another on the third day. The vomitus consists entirely of gastric contents as the obstruction prevents any regurgitation of duodenal contents such as bile. The pyloric tumor can be palpated, a sign pathognomonic of the condition and one which should always be found before operating.

When the obstruction is in the duodenum, vomiting begins shortly after birth and if the obstruction is distal to the papilla of Vater, which is the case in the majority of instances, the vomitus will contain bile. No firm tumor can be felt. If the meconium is examined, squamous epithelium will not be found as that which is characteristically present in meconium arises above the obstruction.

X-ray will help in the diagnosis as the gas-filled stomach will show on a flat film when the obstruction is pyloric, while the duodenum will be seen as well when the obstruction is duodenal. Contrast medium such as barium should not be employed as it may obstruct the stoma should anastomosis prove necessary.

Pyloric stenosis predominates in males in the ratio of 5 to 1 and shows a distinct familial tendency. Duodenal anomalies are apt to be associated with congenital anomalies elsewhere.

Pylorospasm occurs in early infancy and may resemble obstruction. It is not as severe as obstruction; it is intermittent and it can be relieved by atropine and thick feedings. The tumor pathognomonic of pyloric stenosis cannot be palpated.

Congenital obstructions of ileum or jejunum have much the same etiology as those of the duodenum and are decidedly rare. The vomiting commences a little later than in duodenal obstruction and the distention is much more extensive, involving more than just the upper abdomen.

Surgery is the treatment of all these organic obstructions and it should be undertaken at the earliest moment compatible with safety. To operate on an emaciated, dehydrated baby with a distended stomach is to court disaster. The fluid and electrolyte balance should be brought to normal and transfusion given if necessary. The stomach should be emptied by lavage before operation. It may require 2 or 3 days to get the baby in condition to undergo operation but it is time well-spent.

For anesthesia we prefer drop ether unless there is some contraindication. In that case we use local anesthetic of 0.5 per cent procaine. We employ an upper right rectus incision sufficiently high to overlie the liver. Robertson[1] has recently advocated a right subcostal incision which appears to have some advantages.

The operation for pyloric stenosis is the Fredet-Ramstedt procedure introduced into this country by Downes[2] and ably described by Donovan,[3] Robertson[1] and others. Further description is unnecessary. One point deserves mention, however. Opening the duodenum at the distal end of the tumor is an accident which easily happens. Great care should be exercised to avoid it but if it should occur no damage will result provided the opening is immediately closed with fine silk. The Fredet-Ramstedt operation properly done carries a low mortality and effects a complete cure.

The operation for duodenal obstruction is a more serious procedure and has a high mortality. Occasionally it is possible to relieve extrinsic obstruction by cutting a band or correcting a volvulus but usually a much more extensive operation is required. A diaphragm may be cut if that is the cause but in most instances it is necessary to perform a duodeno-jejunostomy. This is tremendously complicated by the contracted condition of the gut distal to the obstruction. Ladd[4] has reported several cases successfully treated by this method and recently Stetten[5] reported another in a premature infant.

Obstructions farther down in the small gut are treated by some form of entero-anastomosis. Sometimes the obstruction is the result of inspissated meconium in a stenotic portion of the gut, in which instance it is necessary to open the gut and remove the obstructing agent.

Atresia ani, next to pyloric stenosis, is the most common congenital alimentary tract obstruction. It is easily recognized by the fact that the baby does not pass meconium. According to Ladd and Gross[6] there are four types: two near the anus due to incomplete rupture of the anal membrane or to persistence of the anal membrane; and two higher up with the rectal pouch separated from it by considerable tissue. In one of the last forms the anal pouch is well formed and unless digital examination is made, the obstruction is not evident. X-ray examination not earlier than 36 hours after birth with the baby inverted will show the rectum filled with gas. If made earlier, or if the baby is not inverted, the gas will not be in the rectum. The anal sphincter is usually present.

In the treatment of these cases colostomy is to be avoided if possible. The rectal pouch is allowed to distend and then the operation is done from below. The sphincter is cut across by an antero-posterior incision and the dilated rectum mobilized by blunt dissection. It is then brought down, sutured to the sphincter and opened.

Congenital anomalies in this region are frequently associated with fistulous connections between rectum and genito-urinary tract but they do not produce obstruction and are mentioned here only in passing.

These congenital obstructions give symptoms early in life. Another obstruction arising later, but none the less peculiar to infancy, is intussusception. This is not a congenital defect, its etiology is obscure and the diagnosis is more often missed than in pyloric stenosis. Perhaps this is because the textbooks give a positive description that is not always present.

The textbooks describe a baby usually between 6 months and 2 years suddenly seized with severe abdominal pain and vomiting followed by shock and prostration. He passes a fecal stool followed by blood or blood and mucus and then the bowel is obstructed. On examination a sausage-shaped mass is felt in the abdomen and often by rectal examination. This description is essentially true but by the time the baby reaches the surgeon the picture may have changed.

In the majority of our cases the chief complaint was bloody stools and sometimes diarrhea. The history of vomiting and pain could be obtained from the parents but only by questioning, as these symptoms had ceased. Mass was felt in only about half as it was obscured by distention; and when it was felt by rectum the condition was advanced and most of the patients died. Instead of a child writhing in agony he appeared to be a healthy infant quietly sleeping. More than once I have had the anesthetist ask if the wrong patient had not been sent to the operating room. The decision to operate should be made on the history as well as on the present findings.

Preliminary treatment is of as much importance here as in pyloric stenosis but because of the danger of gangrene of the intussusceptum it must be hurried and the operation performed at the earliest safe moment without waiting for the maximum improvement. The administration of fluids can be continued during and after the operation.

The intussusception involves terminal ileum and cecum or colon in most of the cases. It is usually single but some we have seen were com-

pound, i.e., more than one intussusceptum was found in a single intussuscipiens. Gangrene of the bowel was present in about a third of our patients, all of whom died.

A right rectus incision is made regardless of where the mass is felt, as in practically all cases the intussusception starts on the right side and it is in this location that the greatest difficulty can be expected in reducing the intussusception. The reduction is made by milking out the intussusceptum rather than by traction which may rupture the delicate gut. In a few instances, however, a little careful traction may be a valuable assistance in the milking process but it should be done with the utmost gentleness and stopped at the first sign of resistance. An air enema, as practised by Farr,[7] given in the operating room with the abdomen open, may help to start the reduction or even accomplish it. This should be done only as a surgical procedure under direct vision because of the danger of rupturing the gut.

When gangrene is present, the surgeon has no choice but to resect the gangrenous gut although most resections result fatally. Infants and children tolerate ileostomy or colostomy so poorly that resection is the method of choice and there have been numerous successful resections reported. Dowd[8] reported one in a four year old boy in 1901 and another in a five day old baby in 1912.

Bleeding from the bowel may simulate intussusception when associated with gastrointestinal symptoms. Henoch's purpura is the principal disease to differentiate, but a bleeding Meckel's diverticulum may cause confusion, and bleeding by rectum in congenital syphilis obscured the diagnosis in one of our cases.

Strangulated hernia is another cause of intestinal obstruction. It is infrequent and when it occurs in childhood usually appears during the first two years of life. We have never had to resect the gut for this condition and in correcting the hernia simply ligate and remove the sac without attempting any sort of repair. A loop of gut twisted around an attached Meckel's diverticulum may also cause obstruction.

The inflammatory diseases of the abdomen in children may be divided into those without associated peritonitis and those with peritonitis. Obviously an inflammatory disturbance may start without peritonitis and develop it later but it will simplify matters to discuss them separately.

The condition for which early operation is imperative is acute appen-

dicitis. The typical syndrome of abdominal pain localizing in the right lower quadrant, followed by nausea and vomiting; tenderness over McBurney's point; fever and leukocytosis is known by every surgeon to be subject to variations. In childhood the symptom complex is even more variable and is easily confused with the onset of certain systemic diseases or with other abdominal inflammations.

The systemic diseases offer the least trouble although fully a third of the cases that are admitted to our service as acute appendicitis fall in the systemic group. The child is more prostrated, the temperature is higher, the abdominal pain is vague and the tenderness is indefinite and slight. Vague abdominal symptoms with a temperature above 103 seldom mean appendicitis and a little delay will serve either to clear up the symptoms entirely or to permit them to develop into those characteristic of the disease. Pneumonia, scarlet fever, tonsillitis and upper respiratory infections are the ones most often found.

Local retroperitoneal or intraäbdominal inflammatory conditions present more difficulties and it is often quite impossible to make the correct diagnosis without operation. Pyelitis, perinephric abscess or cystitis frequently simulate appendicitis and the urine examination, while usually sufficient to establish the diagnosis, may show nothing if the ureter is obstructed. In this connection it is well to remember that a low-lying acutely inflamed appendix may be close enough to the bladder to cause urinary symptoms.

Osteomyelitis of the ilium occurred in one of our patients and so closely resembled appendicitis that operation was performed. With the abdomen open the true nature of the trouble was manifest.

The pelvic inflammatory conditions of little girls are the easiest to differentiate. Salpingitis secondary to vaginitis and pelvic bleeding from rupture of an ovarian follicle or backflow secondary to an imperforate hymen are not particularly uncommon but rectal examination, examination of the vaginal smear and a consideration of the age of the patient will usually make the diagnosis.

Of the acute inflammatory conditions of the bowel, acute Meckel's diverticulitis and acute regional enteritis must be considered. A history of bleeding from the bowel may help with Meckel's diverticulitis but in any case operation is indicated and the diagnosis becomes of academic interest only. With acute regional enteritis the differential diagnosis is almost impossible and in all of our cases was made in the operating room.

They were treated by appendectomy and fortunately none went on to the chronic form of regional enteritis. Neither of these conditions is particularly common.

Mesenteric lymphadenitis is common, however, and is the worst stumbling block in differential diagnosis. In general the symptoms are a little less severe than those of appendicitis and the localization of pain and tenderness more or less indefinite. We usually make the diagnosis in the operating room, however, and remove the appendix as a routine procedure. We do not consider mesenteric lymphadenitis a clinical entity any more than lymphadenitis elsewhere in the body. I believe that it arises from the lymph drainage of infection or toxins in the area drained by the mesenteric nodes and is as protean as the area it drains and the infections thereof. For this reason I believe, contrary to Sobel and Stetten,[9] that removal of these nodes is fraught with danger. It has been done many times by many surgeons and neither culture nor pathological examination has shed any light on the situation; but I have seen three cases in which peritonitis followed removal of the nodes, in one of which death ensued and in another chronic invalidism after many enterostomies and laparotomies for obstruction. Being therefore useless and dangerous it is the perfect example of meddlesome surgery.

Of the inflammatory conditions noted, the treatment for appendicitis and Meckel's diverticulitis is operation; for the others, symptomatic. When the diagnosis of appendicitis is clear-cut there is little difficulty. This happens in only about half of the cases, however, so some other criteria must be established for surgery.

We place most importance on localized right lower quadrant tenderness, especially if the psoas sign is positive or if there is rebound tenderness. History is of next importance with pain and vomiting in their proper sequence. Fever and leukocytosis are of value when taken in conjunction with other evidence. A gangrenous appendix with little or no fever or leukocytosis is a common occurrence. Rectal examination should be done, but, except in older children, is of little value unless a mass is discovered. An adult finger in a child's rectum causes so much distress and active resentment that the examiner cannot tell whether the pain is due to the morbid process or the examining finger. When in doubt we consider that operation is the most conservative form of treatment. Furthermore, if a child gives a typical appendix history, even if abdominal signs are minimal, or if a child has more than one hospital admission

with the same indefinite abdominal symptoms, we operate. By following this course we make mistakes at times but we also find a great many acutely inflamed appendices which would otherwise have been missed; and we have never seen any harm arise from the unnecessary removal of the appendix under such circumstances.

Peritonitis is the most serious intraäbdominal condition and has the highest mortality. That secondary to a perforated appendix is the most common form. The disease starts with symptoms that can be recognized as due to appendicitis and too often there is a history of catharsis. Pain, vomiting, rigidity and distention make the diagnosis obvious. Unless the child is in a very serious condition, we operate, but only after the fluid and electrolyte balances have been restored. The appendix is removed, if that can be easily accomplished, otherwise the operation is terminated. If the condition is diffuse peritonitis we have been putting 4 to 6 grams of sulfanilamide into the peritoneum. Drainage is not practiced unless there is an abscess or unless it is not possible to remove the appendix. Only the peritoneum is closed, the remainder of the wound being left open and lightly packed with vaseline gauze. Our results have been highly gratifying.

Peritonitis associated with gonorrheal vaginitis is not uncommon, although with the use of sulfathiazole it is rapidly becoming so. It resembles primary peritonitis but a vaginal smear will readily disclose its true nature. Operation is not indicated. The gonorrheal peritonitis will subside rather quickly but, should the peritonitis prove to have another etiology, waiting for the abscess to develop may be the best form of therapy.

Primary peritonitis is practically always due to pneumococcus or streptococcus and many observers claim that it is almost entirely confined to girls. This they explain on the ground that entrance of the bacteria is gained via the genital tract and support their contention by the fact that cervical smear will produce the organism in pure culture. Our figures do not altogether support this contention even though there is a preponderance of girls. We agree with Newell[10] who divides primary peritonitis into three etiological groups, viz.: idiopathic; that associated with pulmonary or upper respiratory tract infections; and that associated with nephrosis.

The idiopathic type may predominate in girls but in others the female preponderance is slight. When peritonitis develops after an upper

respiratory infection it is usually a week or more after the onset and the sore throat or running ear is improving. Streptococcus is the organism usually responsible for this type. When associated with nephrosis the peritonitis is not necessarily a terminal condition as some of our patients have been able to form an abscess which can be drained and they have recovered. Pneumococcus is the usual organism in these instances.

The evidence is so typical of peritonitis that the diagnosis is rarely in doubt but as the treatment depends a great deal on the causative organism it is necessary to determine this. If the patient is a girl, cervical smear may give the desired information; otherwise abdominal puncture may be employed.

Our experience with abdominal puncture has not been altogether satisfactory in that sufficient fluid to give the information desired has not always been obtained. Also, the possibility of perforation of the gut with the needle makes the procedure not altogether harmless. Ladd, Botsford and Curnan[11] advocate making a small McBurney incision and opening the peritoneum under local anesthesia. If the peritonitis proves to be due to the colon bacillus, the incision can be enlarged and the appendix removed. If not, the pus can be sucked off and sulfanilamide inserted. This procedure has much to recommend it but we have had no personal experience with it.

Opinion differs as to treatment. Some of our patients recovered after drainage of acute peritonitis; others recovered after allowing an abscess to form and then draining that; but the majority of them died. Our feeling at present is to avoid operation in primary peritonitis until the formation of an abscess which is then drained. If the abdomen is opened under the mistaken diagnosis of secondary peritonitis, the pus is sucked off, sulfanilamide inserted and the peritoneum closed without drainage. The remainder of the wound is left open and packed with vaseline gauze. The proper chemotherapy is then begun by mouth.

Preliminary administration of glucose and saline by vein or hypodermoclysis is always advisable. No dehydrated child should ever be submitted to operation and the restoration of the normal fluid and electrolyte balances may mean the difference between recovery and death.

Summary

Acute abdominal lesions of childhood are either obstructive or inflammatory.

The obstructive lesions occurring directly after birth are congenital; those occurring later are usually due to intussusception.

The inflammatory lesions are usually associated with the appendix but other conditions frequently obscure the diagnosis. Operation is the conservative treatment.

Primary peritonitis may occur, in which instance the conservative treatment is to delay operation until the formation of an abscess and then drain.

Restoration and maintenance of fluids and electrolytes is essential.

REFERENCES

1. Robertson, D. E. Congenital pyloric stenosis, *Ann. Surg.*, 1940, *112:*687.
2. Downes, W. A. Congenital hypertrophic pyloric stenosis, *J.A.M.A.*, 1920, *75:*228.
3. Donovan, E. J. Congenital hypertrophic pyloric stenosis in infancy, *Ann. Surg.*, 1932, *95:*174.
4. Ladd, W. E. Congenital obstructions of the small intestine, *J.A.M.A.*, 1933, *101:*1453.
5. Stetten, DeW. Duodenojejunostomy for congenital, intrinsic, total atresia at the duodenojejunal junction, *Ann. Surg.*, 1940, *111:*583.
6. Ladd, W. E. and Gross, R. E. Congenital malformations of the anus and rectum; a report of 162 cases, *Am. J. Surg.*, 1934, *23:*167.
7. Farr, C. M. *Personal communication.*
8. Dowd, C. W. Gangrenous intussusception in a child four years old, *Ann. Surg.*, 1902, *36:*47; and Resection of one third of the colon for irreducible intussusception in an infant five days old, *ibid.*, 1913, *57:*713.
9. Sobel, I. P. and Stetten, DeW. Nonspecific mesenteric lymphadenitis, *J. Pediat.*, 1940, *17:*305.
10. Newell, E. T., Jr. Primary streptococcus and pneumococcus peritonitis in children, *Surg., Gynec. & Obst.*, 1939, *68:*760.
11. Ladd, W. E., Botsford, T. W. and Curnan, E. C. Primary peritonitis in infants, *J.A.M.A.*, 1939, *113:*1455.

TREATMENT OF DISORDERS OF THE MENOPAUSE*

ROBERT T. FRANK

Clinical Professor of Gynecology
College of Physicians and Surgeons, Columbia University

THE onset of the menopause is a gradual process unless castration is induced either surgically or by radiotherapy. The physiological menopause therefore usually is preceded by a recognizable preclimacteric stage of variable duration.

The menopause is anticipated with dread by a large number of women, because they expect to lose their attractiveness (with appearance of wrinkles, gray hair, flabbiness, hirsutism), sex allure, physical vigor and shapeliness (obesity, angularity). They likewise anticipate a diminution of libido and of mental capacity. They look forward to being harassed by discomforts such as flushes and sweats, headaches, diminished eyesight. Many of these fears, instead of being allayed, are further exaggerated and fixed by the attitudes and convictions of their family physicians.

Preclimacterium: Preclimacterically, and I must emphasize that the preclimax may extend over several years, ovulation becomes less regular or may fail to take place. In consequence, continuous and excessive follicle growth may supervene, causing excess production of estrogens. If this excess is destroyed or excreted with sufficient rapidity, as happens in the majority of women, the individual remains symptomless. If the excess accumulates in the circulation, the symptoms of what I have called "premenstrual tension" develop; if the excess is excreted periodically, menorrhagia and metrorrhagia result. Characteristic of this stage are the uterine findings in such individuals. The uterus shows symmetrical enlargement; at the onset, the uterine muscle is soft and boggy; in the later stages, the muscle becomes hard and fibrous. In both stages the endometrium is found thick, edematous, sometimes polypoid, although occasionally very thin endometria are encountered. Microscopically such endometria show hyperplasia; not infrequently cystic dilata-

* Read Feb. 14, 1941 in the Friday Afternoon Lecture Series of The New York Academy of Medicine.

tion of the glands. At other times the glandular pattern is adenomatous.

Let me warn you that estrogenic therapy, so often resorted to at this time, because many of the patients have mild flushes, is not helpful and may prove harmful, by increasing the menorrhagia as well as the irregular timing of the cycle. It should be remembered that neurovascular symptoms are noted, not infrequently, in patients long before the menopausal years, and in themselves do not signify a premature menopause. This should be emphasized because, when flushes and amenorrhea develop in patients between thirty-five and forty-five, many practitioners habitually make the diagnosis of "premature menopause," an infrequent condition (at most in 4 per cent of women). Moreover, patients who have flushes coincident with amenorrhea, are not relieved by estrogens. Under such conditions, small doses of phenobarbital and repeated reassurance are usually adequate.

Climax: When the menopause develops (this rarely happens before the forty-seventh to fiftieth year, and in women with fibroids even later) very definite changes ensue. These changes are both constitutional and local but should not be confused with the systemic changes incident to advancing years. Sudden and definite amenorrhea develops in less than 15 per cent. The majority show irregularity and increasing intervals between menstruations so that no exact time of onset can be recognized.

Physiological Changes: The most evident, readily recognizable constitutional changes are hormonal and are due to the unopposed and excessive action of the prepituitary or adenohypophysis which thereupon secretes an excess of the gonadotropic factor or factors. This excessive and continuous secretion and excretion can be determined readily by investigation of both the blood and the urine. If the ovaries are examined at this time, and this happens not infrequently during laparotomies performed for valid indications, they will be found to be smaller, fibrous, less vascular, and diminished in weight by one-third. The ovaries contain few or no cystic follicles, and no corpora lutea. As a result, a diminished estrogenic secretion is found both in the blood and in the urine. In many instances the estrogens have disappeared completely. The gonadotropic factors, as stated, characteristically are continuously present in large amount.

There is no evidence that I can accept, showing that other prepituitary factors such as the growth, thyrotropic or adrenotropic are af-

fected. Likewise, there appears no change definitely ascribable to the climax, in blood pressure (except greater temporary variability), metabolism or other general bodily functions. This has been investigated repeatedly in young individuals who have been subjected to castration.

Constitutional Symptoms: The symptom complex associated with the menopause is characteristic. The symptoms may continue for a shorter or longer period. They will be most stormy in nervous, neurotic and imbalanced women, and less marked in the well poised and stable individual.

The symptoms intimately associated with the menopausal condition are neurovascular, digestive, arthritic and psychical in addition to the local involutional changes. Frequently one or more are complained of by the same patient. By far the most common and best known to the laity are the neurovascular: flushes and sweats, headaches and dizziness. These may be extremely disturbing, embarrassing and even disabling. The flushes and sweats awaken the patient at night and cause her to catch cold. The headache and dizziness produce a feeling of insecurity, in extreme cases inducing the patient to stay at home and lead a hermit existence. The digestive symptoms usually are mild: eructations; sudden, variable and unaccountable abdominal distention; increase in constipation, nausea.

The arthritic symptoms are vague. Joint pains are experienced, especially of the metacarpo-phalangeal and metatarso-phalangeal joints; also of the vertebrae, less often ankle, knee and shoulder. When I have had the opportunity of examining previous x-ray films of a somewhat earlier date, and comparing these with more recent films, it became apparent that the pain is not due to any increased bone changes recognizable by x-ray.

The psychiatric symptoms as a rule are mere exaggeration of the previous overt or latent tendencies existing in the individual. Such complaints as unrest, emotionalism (lacrimosity, depression), inability to concentrate, irritability, quarrelsomeness, loss of self-control, become more marked and may then first be noted by family or relatives. As Heaver phrases it, "Such a woman is much more susceptible to minor insults to her pride and ego, and certainly she experiences more difficulty than ever before in coping with these." In a small number of patients, real psychoses develop, in the form of involutional melancholia and paranoid manifestations.

Local Symptoms: The local symptoms of involution or atrophy are mild. The breasts involute, showing atrophy in thin individuals and increased replaced accumulation of fat in the obese. Women with a tendency to obesity quite often at this period note a temporary redistribution of fat producing an enlargement of the hips and of the abdomen. The pubic hair eventually thins out and becomes gray. The labia majora lose their plumpness, the minora shrink and evince pallor. The vagina becomes less succulent, dryer, and paler, but coital disturbances rarely develop. The cervix, particularly the portio, involutes together with the uterus, the entire organ appearing smaller, thinner and rubbery in consistence. The involution of tubes and ovaries cannot be elicited by palpation. Vaginal and cervical secretion diminish. The vaginal smears may show a characteristic menopausal type although this is not the case in a considerable percentage of patients, if spreads are stained with fuchsin or hematoxylin eosin. It should be emphasized that with few exceptions, myomata of the uterus diminish markedly. Myomata which originally were no larger than a tangerine, as a rule, two or three years after the onset of the menopause, can no longer be recognized. Therefore small fibroids first noted in women of forty-five years, rarely require surgical removal.

Menopausal Diseases

While discussing the local changes, it is well to mention the pathological changes which fall into the frame of menopausal diseases.

Senile Vaginitis, manifesting itself by burning sensation, rarely produces actual pain, and is recognized by red, punctate subepithelial spots, and the development of synechiae in the fornices. The vaginal secretion is scant, colorless and alkaline.

Pruritus is recognizable only by scratch marks. *Leukoplakia,* superficial white, discrete areas anywhere on the visible mucosa from the labia minora inward, is due to thickening of the superficial epithelial layers (hyperkeratosis). *Kraurosis vulvae* is a shrinkage of the labia minora with epithelial atrophy, fissuring, often accompanied by leukoplakia, and in 50 per cent of the patients, eventually changing into carcinoma. It should be added that while pruritus, leukoplakia and kraurosis are found in the menopause, the same syndromes occasionally, but much more rarely, appear long before the preclimacterium has set in.

As to corpus carcinoma and ovarian malignancies, it is even more

difficult to determine whether the menopause or the age group is the main determining factor for their greater frequency. I am inclined to think that age is of greater importance. So-called functional ovarian tumors, particularly granulosa cell tumors, through their internal secretion, produce recurrence of bleeding and are therefore more readily recognizable in the menopause. Whether the frequency of carcinoma of the breast in this group has any direct connection with the menopause, I must leave an open question.

On the other hand, I have found no convincing evidence to support the hypothesis that arteriosclerosis and cardiorenal diseases have any direct connection with the climacteric changes, particularly as even in the early stages they do not respond to estrogenic therapy. The same may be said of obesity which to a large extent is due to the emotional factors which so strongly tinge the entire outlook of the laity and produce a self-imposed sluggishness and depression in many individuals. It is true that some investigators have declared that sugar tolerance is decreased and adrenalin sensitivity increased after the menopause.

Treatment

Although all women who survive, eventually reach the menopause, not more than 15, or at most 20 per cent are incommoded sufficiently to seek relief. Of those who consult a physician, a considerable proportion have mild symptoms, for the control of which full reassurance and non-specific medication will suffice.

Non-Specific Treatment of the Menopause: The advice should consist of a description of the situation. The patient should be told that if the symptoms do not increase, very little treatment will be necessary, and certainly that no hormonal treatment, such as injections, of which the laity is now fully aware, will be needed. If the patient is overweight, she should be cautioned and placed on a detailed, mild, reducing diet. The carbohydrates and fats should be restricted, and the patient should weigh herself once a week. Sufficient exercise, preferably walking, should be indulged in. Frequently, measures to relieve constipation are likewise indicated.

For the mild flushes and sweats which annoy the patient, mostly at night, one-half of a grain of phenobarbital before retiring, may be prescribed. Occasionally one-quarter of a grain may be necessary during the day time. The sedation should be regulated below the dosage at

which day time sleepiness is induced.

The majority of these patients will seek advice at intervals because they are disquieted by their gossipy friends as well as by the articles which they read in the newspapers or magazines, with consequent reawakening of their fears.

Specific or Replacement Therapy: Particularly after the induction of the menopause by surgical castration or by x-ray, the symptoms may prove stormy and severe. This applies most frequently to young nervous women. Occasionally some of the patients, in whom the non-specific therapy just described has failed, may likewise demand further aid. Complete relief of symptoms is attained by natural or synthetic estrogenic substances. In my experience, less than one per cent of patients do not respond to the estrogens.

Pharmacology of the Estrogens: Today the estrogens may be obtained as pure chemical entities. Their characteristic is induction of artificial estrus in laboratory animals (mainly rodents). The estrogens exert their effect upon the uterus, vagina, vulva, Fallopian tubes, as well as upon the breasts. Immediately after the beginning of absorption, temporary local, as well as slight peripheral vasodilatation manifests itself. The contractile response of the musculature of the uterus and tubes which was abolished or diminished by castration, returns. The uterine mucosa undergoes changes due to the stimulation. The vaginal spreads change to the estrual type. Similar effects are produced in the human being by sufficient dosage. The vaginal spreads show definite and recognizable changes. The response to estrogen continues until the drug is withdrawn or eliminated. In addition, in the human being, as the result of effective estrogenic therapy, a readily recognizable disappearance of the gonadotropic factors in the urine is demonstrable by simple laboratory tests.

In the rodent, long continued exhibition of estrogen produces enlargement of the prepituitary, and in susceptible strains of mice, adenocarcinoma of the breast. In the guinea pig, diffuse fibromyomata of the uterus and peritoneum may develop. Analogous results have not been recorded in the human being.

Available Estrogens: More than one hundred active pharmaceutical products are on the market. I do not consider it my function to single out a given product. The estrogens may be used in a number of ways. An unnecessarily popular form of exhibition of the drug is by subcu-

taneous or intramuscular injection. The estrogens must be dissolved in oil as their water solubility is minute. Since this method of medication has become so popular, I have seen a number of patients who develop a sensitivity to the oily medium, producing severe local allergic reactions and necessitating the stoppage of this form of giving the estrogen. Some of the estrogens are absorbed by mouth, particularly estriol and estradiol. Absorption likewise takes place through the vagina and through the skin. Recently, implantation of crystalline estrogens subcutaneously has been tried (As a rule, such implantation necessitates a small incision, under local anesthesia, and suture of the wound). In the great majority of cases the estrogens may be given by mouth. It is to be remembered that during absorption a considerable portion of the drug is carried off in the intestine and destroyed by the liver, and, therefore, the dosage must be increased ten times above that used for injection.

Unitage of the Estrogens: At the present the dosage is in a state of confusion which misleads practitioners unnecessarily. The generally accepted and basic unit is the international unit of estrone (I.U.). This is arbitrarily 0.1 of a gamma or 1/10,000 of a mg. of estrone. This roughly corresponds to 1 M.U., a quantity which will produce full estrus in a castrated mouse. There is a benzoate unit which corresponds to 0.1 of a gamma of estradiol benzoate. This unit should be abandoned. Many of the pharmaceuticals are based on the Rat Unit (R.U.) which roughly corresponds to 5 I.U. The commonly used estrogens may be grouped as follows according to their physiological effectiveness: Estriol—one-sixth of the effect of estrone; estrone—the unit; estradiol—five times as effective as an equal weight of estrone. This should suffice for any practical purpose.

For general purposes, tablets of estradiol in the dosage of one-half mg. of the active substance, three times a day, by mouth, is sufficient for the great majority of patients. I have seen no advantage in using the other forms of natural estrogens although for vaginal suppositories estrone is sufficiently strong.

The main objection to the continued use of estrogens is their high cost. This drawback doubtless will be overcome eventually by synthetic estrogens. In England and Canada, Stilbestrol, a synthetic estrogen, is permitted to be sold. Its price is less than one-tenth of that of the natural estrogens. As yet, the Food and Drug Administration has not authorized its sale in the United States. This is largely due to the fact

that approximately one out of ten patients develops nausea as a result of taking the drug and that when given in large doses, liver damage has been said to result.

Method of Use of Estrogens in the Menopause

I hope that in what has preceded, I have sufficiently cleared the decks to describe the actual use of estrogen in given cases of the menopause. By this medication it is usually possible to abolish rapidly the flushes, to relieve digestive disturbances and, in most cases, to lessen the arthritic pains. Usually, too, these patients experience a feeling of well-being and increased physical vigor. Rarely an increase of libido is noted. I have seen no convincing evidence that high blood pressure is influenced or relieved.

It is my practice to prescribe thirty tablets, each containing one-half mg. of alpha estradiol. These tablets are to be taken at first three times a day, a half hour after each meal, until the flushes definitely improve or cease. In the average patient this occurs after four days. The patient is then told to take only two tablets a day, one in the morning and one in the evening, until the last three tablets are reached. Then the patient takes but one tablet in the morning for three successive days. By this gradual withdrawal, annoying bleeding in patients who have their uteri, usually is avoided. The patient is directed to take no further medication except one-quarter of a grain of phenobarbital, twice daily. With the first reappearance of flushes, a similar course of estrogenic treatment is repeated. The aim is to lengthen gradually the withdrawal periods until no recurrence of symptoms takes place. No definite prognosis as to the duration of the condition can be given. In general, it may be said that the more nervous the patient, and the more frequent and severe the flushes, the longer will active menopause symptoms continue, but as this may cover a time anywhere between six months and six to ten years, it is unwise for the physician to predict.

In my hands this type of medication has been successful in the vast majority. I have not resorted to the overpopular method of injection for several years. Injections cannot be carried out indefinitely without the patient eventually rebelling. As previously mentioned, allergy to oil may necessitate resort to other methods. Abscesses and granulomata have occurred. If injections are resorted to, the best type of medication is estradiol benzoate, obtained from a reliable firm. The injection should be

given twice or thrice weekly until the flushes are fully abolished. The individual dose is two thousand Rat Units. After the flushes are under control, weekly injections are resorted to. Under this type of medication, irrespective of their age, annoying uterine bleeding is much more apt to occur in patients in whom the uterus has not been removed. I have seen it in a woman seventy years old, and therefore patients should be warned of this possibility, in order not to be unpleasantly surprised or alarmed. Some endocrinologists feel that the psychic effect is greater when injections are resorted to, but unless we are entirely mistaken in our concept of estrogenic therapy for the menopause, no psychotherapy is needed.

I see no advantage in attempting to give estrogen treatment by means of inunction. It is true that the estrogens are readily absorbed by the skin. However, it is impossible to gauge the dosage as accurately as by the other routes. Moreover, we are as yet unable to exclude definitely a potential local carcinogenic effect in the human.

The advocates of implantation have stated that the absorption by this method is more continuous and that an implantation effect may last for one to three months or even longer. Sterile crystalline estradiol is compressed into small tablets and by an incision, placed in the subcutaneous tissues. The rate of absorption varies according to the density of the pellet, the surface area exposed, and the greater or lesser connective tissue reaction which encapsulates the pellet. Once introduced the dosage is no longer under control. How successful the instrument devised by Thorn for implanting other types of steroids will prove to be in avoiding the necessity of scarring incisions, I cannot state from personal experience.

Vaginal suppositories containing from one thousand to two thousand International Units likewise cause absorption of estrogens. The suppositories are placed deep in the fornix by the patient before retiring. The patient wears a napkin until morning and then takes a cleansing douche. I resort to this type of medication mainly when a senile vaginitis causes annoying irritation and discharge, and the constitutional symptoms are mild.

In the last few years great enthusiasm has been shown by psychiatrists for the estrogen treatment of menopausal psychoses, particularly melancholic and schizophrenic manifestations. It seems to me that the primary enthusiasm will gradually evaporate. There is no question that

the menopausal symptoms can be abolished, thus affording some relief and inducing marked hopefulness in some of these women. However, I doubt that cure of deep-seated and well-developed psychoses can be anticipated. However, there is no reason whatever why such medication should not be tried under careful and critical supervision.

Contraindications: Although in my opinion the use of estrogens is much overdone and is not at all indicated in the preclimacteric period when menstruation still occurs, there are actually few other contraindications for the use of estrogens. Estrogens should not be used postoperatively in patients in whom endometriosis has been found. The same applies to patients operated upon for carcinoma of the breast, or either operated upon or treated by radiation for carcinoma of the cervix and carcinoma of the uterine body.

Another mainly climacteric disease, namely kraurosis of the vulva, has been treated by estrogens. This condition is an atrophic one and usually a sequence of the menopause. In my experience, fully 50 per cent of kraurosis of the vulva changes into carcinoma of the squamous type. Knowing the definitely carcinogenic potentialities of estrogens, it seems unwise to further complicate the situation by giving estrogens in any form, particularly by local inunction. I am further encouraged in making this contraindication absolute by the fact that I employed the method years ago when carcinogenesis and steroids were not at all associated, and found that any change or relief obtained was of purely temporary nature.

It is my hope that I have been able to clarify for you some of the confusion and misconceptions which becloud this as yet new therapeutic treatment. Those of us who have been interested in endocrinology for many years consider the estrogenic relief of the menopause as a major triumph, second only to that of the treatment of hypothyroidism by thyroid medication and of diabetes by insulin.

MEDICAL TESTIMONY IN PERSONAL INJURY ACTION*

The Honorable WARNICK J. KERNAN

Chairman New York State Law Revision Commission

IT is conceded, I believe, at the outset of our discussion, that medical testimony, in the so-called personal injury action, involves an evil which seriously affects the administration of justice. The causes of the evil must likewise be conceded. In their consideration, three important elements are generally found to be present, each one of which is a contributing factor, namely: the opportunity for the doctor to predicate his opinion on subjective symptoms, which induces exaggeration, if not worse, on the part of a claimant; the very natural tendency on the part of a doctor, by whatever party to a lawsuit retained, to become a partisan in the action, whereby the skilled adviser loses that disinterestedness, without which the testimony of any witness is so readily colored; and the contingent fee contract of the lawyer, made necessary, in so many instances, by the circumstances of the client, which provides a stake, in the way of remuneration, out of all proportion to the service, arousing as it so often does his cupidity and breaking down all resistance against unethical practices. With claimant and lawyer both in a position to benefit from the size of a verdict, there is an ever present temptation, difficult to combat, and it is not surprising to find an exaggeration, in very many cases, which frequently takes on the aspect of fraud, as well as doctors whose opinions are purchasable. As a result, expert testimony, in the kind of action we are considering, has gained such a disrepute that very many medical men will refuse to become identified with either party, whether plaintiff or defendant, and a cynical public, seeing the perjured cause prosper, becomes contemptuous of a profession which permits it, and is weakened in its respect for the courts. Arguing from the one type of cause, it reaches the wholly un-

* Read February 25, 1941 before The Association of the Bar of the City of New York in the symposium in coöperation with The New York Academy of Medicine and the Medical Society of the County of New York.

justifiable conclusion that every lawyer, in every case, is moved by an interest which knows no deterrent to a successful outcome; that false testimony is not merely condoned, but is encouraged; and that the judge, whose function is to promote the administration of justice, is indifferent to the spoken lie in his presence, or without courage in its rebuke.

This statement of the evil with which we are confronted, and its effect, will not be seriously challenged, and if the prestige of our courts is to be maintained, there must be some affirmative action upon our part. A plea of helplessness by the profession is an admission that our judicial system is lacking in that vigor which is essential, if it is to continue to exist. It is more than that—it is an invitation to take increasingly from the courts the jurisdiction which the courts have for so long enjoyed in the determination of legal disputes.

If the tendency of the last twenty-five years to create departmental boards or agencies for the adjudication of specialized questions is not explained by the abuse of expert testimony in the personal injury action, the abuse has at least made easier the trend, and the task of the lawyer, in effecting administrative reforms, is made more difficult. It may seem a far cry, but, as much as anything else, the excessive growth of departmental boards and agencies bespeaks a want of confidence in the law. Unless we can maintain such a standard of procedure that loose and perjured testimony is discouraged, and the perjurer is made to fear, we lose the weight which might be expected to attach to our views, and our protest of the narrowed province of the courts, and the lessened field of the lawyer, is of little avail.

It is not to be gathered from what I have said that conflicting opinions are always indicative of the abuse of expert testimony. Upon very many subjects involving skill and experience, exact conclusions are not to be had upon the same statement of facts, and searchers after the truth, however honest their effort, will differ as between themselves. But there is the dishonest, the careless, and the indifferent expert to be considered, whose biased findings are always available to confuse the particular issue and to bewilder a jury, as well as a court.

The Law Revision Commission of the State of New York early recognized the evil which is inherent in expert testimony in the personal injury action, and in its 1936 program, there was included a proposed statute, designed to meet, or, at least, to minimize the evil. Under its

terms, in any civil action to recover damages for personal injuries, the court, of its own motion, before or during trial, was empowered, in its discretion, to appoint a disinterested physician to make such a physical or other examination of the injured person, as might be necessary to form an opinion as to the nature, extent, or permanence of the injury. The report of the physician so appointed, was to be in writing, under oath, and was to be forthwith furnished to the judge, a copy to be furnished as well to the attorneys for each of the parties to the action. Thereafter, such physician might be called and examined as a witness by either party, or by the court, and he was made subject to examination and objection as to competence and qualification as any other witness, and as to bias, and might be cross-examined. The compensation of the physician, which is always a difficult problem in the devising of any plan, was to be fixed by the court, for the payment of which the parties were made jointly and severally liable; or the court might determine the proportion in which it should be paid by the parties, and any amount paid was made taxable and was allowed to a successful party, as any other cost. If any person paid or offered to pay, or accepted or agreed to accept, more than the compensation fixed by the court, it was made a contempt and punishable accordingly.

An added provision, which should be touched upon, was that the appointment by the court of a physician was to be "after a hearing to be attended only by the parties interested or their attorneys," it being assumed that any appointment would involve a discussion of personalities, as well as questions of compensation and payment, which might be better carried on if there was an absence of the publicity which would be attendant upon a discussion in open court.

Behind the statute suggested, there were two thoughts. The statute, in itself, would furnish to the court an effective means whereby, in a proper case, there might be brought to bear such an examination as would make possible the ascertainment of the truth. This possibility was evidenced, in my own experience a few years ago when an upstate judge, acting beyond his powers, announced to opposing counsel there had to be an examination by a physician of his own choice during the noon hour, the opposing doctors having contradicted each other as to an objective symptom or condition which could be ascertained with certainty, and when the court reconvened in the afternoon, the doctors had left, and what had been bitterly disputed, was an admitted fact in the

case. More than this, even if the power vested in the court should not be exercised, its very possession would be in the nature of a check upon a medical expert. A medical witness will be more thorough in his examination, more studied in his opinion, more careful in his utterance, and less prone to exaggeration, to say nothing of wilful misstatement, if he knows that at any moment the court may itself order an examination.

A big stick in the hands of the court, in the situation we are considering, may be as effective as a big stick in the hands of the mythical individual, who was counselled by a former President to walk softly and never to be without it.

Whether the power contemplated by the proposed statute would prove effective, would depend very largely upon the judge. In the hands of a weak judge, it might be abused, or at best, it would not be invoked. But in the hands of a competent judge, it would be an added power, and given sufficient power, there is no evil with which a court cannot adequately cope.

Why there should be hesitation in the giving of the power, assuming the mechanics of any proposed statute are unobjectionable, is difficult to understand. The determination of the issue in the case will still be with the jury. The judge will still be restrained in commenting upon the weight of the evidence and the credibility of any witness, although, in my opinion, his enforced silence, in such respect, is one reason for the acuteness of the evil under discussion.

New York has for so long enforced the rule, mistakenly, I think, that a judge, neither by word or act, is to influence even remotely a jury, that he is little more than a kind of glorified arbitrator between opposing counsel, to direct the course of a trial. As lawyers, we all wish to win our causes, and there is a point beyond which in any trial, the interference of the court may be properly resented. But the cause which cannot withstand the scrutiny of a competent judge, and his disinterested comment, is questionable, and it would make for a better administration of justice if both the questioned cause, and the unprincipled lawyer who pleads it, could be made to appear in their true light.

In failing to legislate, the Legislature is not to be criticized. The subject of medical testimony in the personal injury action is one in which the urge for legislation should come from the legal profession and any urge upon our part has been wanting. It is one of our weaknesses that there are too many subjects upon which we are silent until an evil

has attained such proportions that the insistence for some reform comes from without.

Neither is the Law Revision Commission to be criticized. Its function is to study and recommend, and this it has done. When a recommendation has been submitted, with its accompanying study, information is at hand, and for the Law Revision Commission to attempt to force its conclusion would be to invite a clash of opinion and threaten the value of its work. Beyond making a thorough and impartial study, the Commission has no interest to serve, and any recommendation must speak for itself.

Legislation affecting expert testimony, in an effort to insure a measure of certainty, is not a novelty. Already, laws have been enacted in New York, which affect it, to a certain limited extent, in matters having to do with criminals and the criminal law. Thus, under section 31 of the Judiciary law, in a criminal action or proceeding, or in habeas corpus or certiorari proceedings to inquire into the cause of detention, in which soundness of mind is an issue, the court may appoint not more than three disinterested competent physicians to conduct an examination, whose compensation is made a court expense, and any such physician may be sworn as a witness at the instance of any party. Sections 658 to 662-a of the Code of Criminal Procedure likewise provide that where the defendant in a criminal action pleads insanity as a defense, the court may appoint a commission of not more than three disinterested persons, at least one of whom shall be a qualified psychiatrist, to examine the defendant and report to the court as to his sanity at the time of the commission of the crime, and if the commission finds the defendant insane, the trial or judgment must be suspended until there is a return of sanity, provision being made, in the interim, for his confinement in an appropriate institution. Under section 870 of the same code, if a person in confinement appears to be insane, power is given to the court to commit to a state hospital, which is obligated to take proper measures for the determination of the question of insanity, or the judge may himself institute an investigation, calling two legally qualified examiners in lunacy, as well as other witnesses, whose fees are audited and allowed by the judge and paid for as a county charge. And under section 125 of the Mental Hygiene Law, any person alleged to be a mental defective, who is arraigned on a criminal charge, may be placed either before or after trial, or conviction, in a hospital for examination, such examina-

tion to be made by two qualified examiners, or a qualified examiner and a qualified psychiatrist, who are paid in the first instance out of public funds. Upon their report, if the examination discloses that the alleged defective is of such a nature as to require supervision, control and care for his own welfare, or the welfare of the community, the judge is empowered to proceed accordingly.

Also, in an action of annulment, independently of any statute, and solely upon the ground of public policy, in order to prevent collusion, the court has reserved to itself the right to direct the examination of a party by medical experts of its own choice, where physical incapacity is an issue.

In each of the legislative enactments referred to, it will be noted that a certain measure of responsibility is placed upon the judge in the sense that he is the motivating authority. The payment of experts is also within his control and is in the nature of a public charge.

Other jurisdictions, notably Rhode Island and California, have enacted statutes enlarging the power of the court upon the motion of the parties, and in California, upon the motion of the court as well, so as to include the appointment of experts in civil actions. Whether because of defects in the statutes, or because of an unwillingness on the part of the court to invoke the power conferred unless requested by the parties, there is a lack of convincing proof that the statutes have resulted in substantial benefit. In fact, in Rhode Island, the statute is a dead letter. In California, the views of the judges as to the worth of the California statute differ, some reporting that they use it only on the approval of attorneys representing all parties, others, that they have little use for it, and a few that they do not use it at all.

In England, under what are termed New Procedure Rules, the court is given certain broad powers in civil actions, but a study of the English statutes is not immediately helpful so far as our problem is concerned, because it seemingly permits the dispensing with a jury, which would give rise in this state to a constitutional question.

Any statute enacted must necessarily be experimental. As was said by the Law Revision Commission, in the submission of its proposed statute, is the proposed statute workable, and will it remedy abuse? Will the court avail itself of its enlarged powers? Are there weaknesses in the statute, and can it be strengthened? To what type of action, usually giving rise to expert testimony, can the statute be extended? When

sources of original information are no longer available, in what way will the disinterested expert be acquainted with the facts, which will insure an accurate finding?

These are only a few of the questions which can be asked. Others will readily suggest themselves. Provisions which are sound in theory may prove unsound in practice. It is only by trial and error that points of weakness in any statute can be uncovered. Whether a statute is practicable, serving any worth while purpose, can only be determined by use.

Even more important, assuming there is any legislative enactment—there must be the effective coöperation of the bar. A willingness to assist the court, in what must be an unpleasant and difficult task at best, will be in itself a long step forward in making any statute effective, thereby helping to overcome the evil at which the statute is aimed. Given the required tools, the bench, working with the bar, can bring to a disputed issue of injury such a measure of certainty, in very many cases, that the task of a jury will be lightened, and expert testimony, in the personal injury action, will cease to be a scandal and a reproach.

THE EVOLUTION OF CLINICAL SPHYGMOMANOMETRY*

WILLIAM HALL LEWIS, JR.

Assistant Visiting Physician, Bellevue Hospital

THE pressure of the blood within its system of circulation has always been one of the major physiological manifestations of health and of disease. Knowledge of the behavior and significance of this pressure was, for long, slowly accumulated; and its development depended upon the evolution of certain techniques. The common clinical method of measuring the blood pressure by a mercury manometer and a stethoscope over an artery is a comparatively recent procedure, in fact more recent than clinical electrocardiography. A few remarks on its evolution may be of interest.

Though the circulation of the blood was established as fact by Harvey in 1628; and the pressure of blood in the circulation was shown in a measurable way by Hales in 1733; and the use of a manometer using fluid, either water or blood and later mercury, was well-known and employed in physiological circles in the latter half of the Nineteenth Century, the clinical technique did not evolve until after the turn of the century, and did not become widely used until thirty years ago. Yet, the art of simple palpation of peripheral arteries has undoubtedly existed as long as the art of medicine; the ancient physician, one can justifiably suppose, made crude but often significant deductions on the tension of the arteries, even before he realized the nature of the circulation of the blood. The exact formulation of such observations awaited the use of instruments of precision and a technique for their application. Janeway[1] expressed aptly this historical point when he wrote, "that the blood exerts pressure upon the vessels through which it circulates is, of course, a necessary corollary of the fact that it flows; but more than a hundred years elapsed before Harvey's discovery of the circulation was followed by Hales' demonstration of the blood pressure in 1733, and a second century before its accurate study was begun."

* Read November 13, 1940 in the Section of Historical and Cultural Medicine of The New York Academy of Medicine.

My purpose in this paper is the history of the concept of sphygmomanometry and of the introduction of its various techniques into clinical medicine; the development of the instruments has been considered elsewhere.[1,2] There are four techniques for measuring the blood pressure; in historical order they are: the method of palpation, first without, later with, the use of a manometer; the method of direct measurement; the method of recording the oscillations of the pressure; and the method of auscultation.

Simple palpation, without doubt, has been an old natural procedure. It became of more value with the use of a manometer for recording the pressure necessary to obliterate the pulse, of which I shall say more later.

In 1733, Hales[3] introduced the technique of direct mensuration by placing a tube in the artery of an animal and obtaining the height to which the blood flowed, a procedure still employed widely today in modified form and primarily for physiologic investigation. Yet a century elapsed before the accurate study of the blood pressure began, as Janeway pointed out, with the introduction by Poiseuille[4] in 1828 of the device of mercury in a U-tube. This procedure separated the observation of the blood pressure from the difficulties of large and unwieldy apparatus and provided the convenient facilities of a small instrument. Also, with the use of an anti-coagulant substance, sodium carbonate, to keep blood from clotting in tubes, Poiseuille made prolonged experiments possible.

Twenty years later, in 1847, the second major advance in accurate study was initiated by Ludwig[5] with the invention of the kymograph. Its application to indirect measurement of the blood pressure by the use of a pelotte placed over an artery and connected with a manometer and thereby dispensing with puncture of the artery, was suggested in 1855 by Vierordt;[6] but his apparatus was unreliable as well as cumbersome, and the results too variable. According to Brim,[7] the device of Vierordt had been suggested by Herisson in France twenty years previously. But Herisson's apparatus did not have the kymographic attachment; and, failing to become an established instrument, it did not spread the conception of a new clinical procedure. The kymographic technique, though still using direct puncture of the artery and, therefore, restricted to measurement on animals, provided permanent records, permitted more objective observation and, with various modifications, afforded a wide

play for physiological study. From the work of this time, especially by Marey,[8] the manometric value of the pressure necessary to obliterate the pulse wave was shown to be a valuable criterion for measurement of the blood pressure. However, a suitable technique and accurate instruments for indirect measurements had not been developed. Sphygmomanometry had not yet become adaptable to man. It began to be so with the device of von Basch,[9] introduced in 1876. von Basch's important contribution consisted of eliminating the direct puncture of the artery and the direct registration of the blood pressure by a column of fluid; instead, he used a bulb or pelotte at the end of a manometer to compress the artery of an extremity so that the wave of pulsation could be gradually eliminated and allowed to return. He introduced two new and fundamental principles; one, the pressure against the extremity and, therefore, the artery could be supplied by a bag containing fluid for compression; and, two, the connection of a mercury manometer to the bag would record the pressure necessary to compress the artery. In accord with these principles, a number of instruments were devised by von Basch, Marey [10] and others. The chief modification by the former was the introduction of a portable metal manometer. More flexibility of use came in 1889 when Potain[11] replaced water with air for compression. His apparatus consisted of a bulb which was placed over the artery and inflated by a second bulb; the pressure was recorded in a portable metal gauge. Again, various modifications, such as by Mosso[12] to register the pressure in the fingers, and by Hürthle,[13] were made in the device, using air for inflation, but the instruments were too complex for general medical use.

Though more easily performed, sphygmomanometry still remained unsatisfactory. The simpler apparatus gave erroneous results; the more complicated ones were too cumbersome. Furthermore, the von Basch-Potain procedure recorded pressure against the more solid tissues of the arm, as well as pressure directly on the artery.

In 1896, Riva-Rocci[14] reported a convenient and more accurate device, on which the modern procedure depends. The method relied upon circular compression of the extremity. In his arrangement, a rubber bag was made to encircle the arm and was inflated by a rubber bulb, pressure from the arm band being registered in the manometer. The artery, therefore, was compressed at right angles from all sides equally, and the application of pressure on non-arterial tissues only was avoided.

Riva-Rocci originally used an armband 5 cm. wide, which was the source of some error. Being narrow, it depressed the tissues at an angle and pressure was recorded against the upper and lower shelf of tissues, as well as against the artery. This source of error was eliminated by the use of a band 12 or 15 cm. wide, the advantages of which were demonstrated by von Recklinghausen[15] in 1901, and a few years later by Stanton,[16] Erlanger,[17] Erlanger and Hooker,[18] and Janeway.[1]

Up to this time, the major criterion for the presence or absence of the pulse wave beyond the constricting band was palpation; palpation gave an accurate enough clue to the systolic or maximum level but did not indicate accurately the diastolic level and, therefore, the mean and pulse pressures. Furthermore, it required a trained sense of touch to appreciate the ebb and flow of the pulse wave. The oscillatory or visual method of taking the blood pressure with the air pressure cuff and manometer lessened the subjective error inherent in the palpatory technique but it was not a procedure adapted to rapid and accurate clinical work. The method depended upon the oscillations transmitted to the fluid in the manometer as the pulse wave came through the compressed artery; the appearance of definite oscillations denoted the first or systolic pressure, the change from large to small oscillations, the diastolic pressure. A variety of instruments, such as by Hill and Barnard,[19] von Recklinghausen,[15] Potain,[20] Erlanger,[17] and Janeway,[1] were soon produced on the Riva-Rocci principle; they relied on the oscillatory as well as the palpatory method and employed either the mercury or the aneroid manometer. By devising an apparatus with a needle pressure gauge primarily for measuring the diastolic pressure shortly after Riva-Rocci's report, Hill and Barnard[19] in England assisted materially in this period of advancement in clinical sphygmomanometry. Also, the more special instrument of Erlanger,[17] employing the kymograph, provided not only accurate but written records of the oscillations of pressure in the air-pressure cuff as it affected the pulse wave. These instruments made possible investigations[18] which established the value of both maximal or systolic and minimal or diastolic readings in the clinical appraisal of blood pressure.

The final step, however, which allowed full scope to, more accurate observation in, and a standardized technique for clinical sphygmomanometry came in 1905 with the introduction of auscultation, devised and reported by Korotkoff.[21]

I have taken particular interest in seeking the original reports of Riva-Rocci and of Korotkoff. Their articles were in journals of limited circulation. They have not been fully reported in English, and bibliographic references are often made inaccurately. I was able to find the original copy of Riva-Rocci's report and that of Korotkoff through the courteous assistance of three gentlemen—Dr. Archibald Malloch, librarian of The New York Academy of Medicine; Mr. Paul North Rice, chief of the Reference Department of the New York Public Library; and Colonel Harold W. Jones, librarian of the Army Medical Library, Washington, D. C. According to the Union List of Serials, the only issue of the journal containing Riva-Rocci's report known to be in libraries in this country is in the Army Medical Library, and the only available issue containing Korotkoff's report is in the Slavonic Division of the New York Public Library.

Riva-Rocci's report was given under the following title: "Un nuovo sfigmomanometro," *Gazetta medical di Torino, 47:* 981-996 (no. 50, Dec. 10); and 1000-1017 (no. 51, Dec. 17), 1896. I should like to give a summary of a translation* of his report.

Riva-Rocci first recorded the purpose of his research on arterial pressure and then set forth the simpler aspects of hydraulics involved. He gave a fairly voluminous review of the literature and described the three types of the von Basch sphygmomanometer available commercially at the time. He preferred the first, or mercurial, model completed in 1881, to the non-mercurial manometer produced in 1883. Riva-Rocci adopted a modification of von Basch's instrument, which was similar to that proposed in 1881 by Rabinowitz, of which Riva-Rocci was not aware. Riva-Rocci's instrument was a "sphygmomanometer likewise based on the principle established by Vierordt and improved on by Marey and von Basch in turn. In other words, it is an instrument affecting manometric measurement of the force necessary to impede the progression of the undulation of the pulse. Sphygmomanometry is then applied to one of the large aortic branches, to the humeral. Since the humeral is the direct continuation of the axillary (since the region contains no collateral large enough to be considered as a branch of the bifurcation), the measurement gives the total charge of a point fairly close to the aorta or, if you like, of the charge of pressure either in the aorta itself (if the left humeral is concerned) or of the brachio-cephalic

* Translations of the articles of Riva-Rocci, Korotkoff, and Krilov were obtained through the facilities of the Library of The New York Academy of Medicine.

trunk (if the right humeral is concerned)." Riva-Rocci considered that his instrument was easy to apply, rapid in action, precise, and innocuous. It was composed of two parts, one for exerting pressure, one for measuring the pressure exerted. The compressor apparatus was represented by a tubular "muff" with walls soft, non-extensible, and impermeable to air. It consisted of a rubber tube 4 or 5 cm. in diameter, lined with a cloth sleeve to prevent undue dilation of the tube. One end of the tube was open, while the other was attached to a piece of metal made in two parts. The patient's arm was tested with this tube plus an insufflator. The intercalation of a manometer revealed the pressure on the "muff" at all times, and hence the pressure exerted on the arm.

Riva-Rocci stated: "The most reliable manometer is still the mercury manometer, but it is necessary to facilitate its reading by adopting a single branch, as in the manometers of Marey and of François Franc, and the original model of von Basch. In order to render the apparatus easier to handle and transport I, too, have adopted the metal manometer. So far, I have been able to obtain only the holosteric kind, since the aneroid kind is of more delicate construction."

In order to prove that his instrument really measured the total charge of the arterial pressure, Riva-Rocci made a number of experimental observations, one series with artificial circulation inside rubber tubes, another with the cadaver arm, and a third with animals.

In the succeeding decade, clinical sphygmomanometry for the first time became a domain of increasing interest and of valuable application in the study of health and of disease in man. Considerable and fairly exact observations and deductions were carried out by physiologists such as von Recklinghausen, Hill, and Erlanger, and by clinicians such as Janeway. But the procedure and its interpretation were confined to a relatively limited medical group.

The opportunity for its wider application was soon offered. In 1905, Korotkoff[21] in Russia reported that by placing a stethoscope over the brachial artery at the elbow below the air-pressure cuff, sounds of the column of blood which flowed into the artery on release of the pressure became audible. Korotkoff's observations were given at a meeting of the Imperial Military Medical Academy in St. Petersburg, December, 1905 and reported in the bulletin of the Academy, "Izvestiya Voenno-meditsinskaie Akademiia," page 365. The original report occupies only a portion of one page in the bulletin, with the title: "On methods of

studying blood pressure (from the Clinic of Prof. Feodoreff)." A translation in full reads:

"On the basis of his observation, the speaker came to the conclusion that a perfectly constricted artery, under normal conditions, does not emit any sounds. Taking this fact into consideration, the speaker proposes the sound method for measuring blood pressure on human beings. The sleeve of Riva-Rocci is put on the middle third of the arm; the pressure in this sleeve rises rapidly until the circulation below this sleeve stops completely. At first there are no sounds whatsoever. As the mercury in the manometer drops to a certain height, there appear the first short or faint tones, the appearance of which indicates that part of the pulse wave of the blood stream has passed under the sleeve. Consequently, the reading on the manometer when the first sound appears corresponds to the maximum blood pressure; with the further fall of the mercury in the manometer, there are heard systolic pressure murmurs which become again sounds (secondary). Finally all sounds disappear. The time of the disappearance of the sounds indicates the free passage or flow of the blood stream; in other words, at the moment of the disappearance or fading out of the sounds, the minimum blood pressure in the artery has surpassed the pressure in the sleeve. Consequently, the reading of the manometer at this time corresponds to the minimum blood pressure. Experiments conducted on animals gave positive results. The first sound tones appear (10-12 mm.) sooner than the pulse which (l. ar. radialis) can be felt only after the passage of the major portion of the blood stream."

This was the complete report. It may be of interest to record the discussion at this meeting. It was as follows:

Dr. An. N. Ivanov: How do you explain the origin of the sounds below the sleeve in the beginning and in the end of the examination?

The Speaker (Dr. Korotkoff): In this instance, the pressure in the sleeve is near the minimum pressure in the artery but still in the sleeve it is greater; with the blood stream slipping through, the walls of the vessel separate and give a short, flapping sound.

Dr. Ivanov: What difference did you observe between the minimum and maximum pressure in the brachial artery?

The Speaker: The differences varied greatly, but with a 25-35 mm. norm and higher.

Dr. B. G. Bojovski: If I understood correctly from your very interesting

report, you ascribe the origin of the sound phenomena in your simple experiment to purely local causes. The mechanism of the origin of murmurs is understood and does not need any explanation, but as to the development of sounds on the spot I cannot at all agree with you. Your explanation of the origin of sounds below the sleeve as a result of the sharp fluctuation in pressure, with all its appeal, cannot be considered the most important or possibly the only source of the sounds in the circulatory apparatus—the heart. Sounds which can be heard in some more or less large vessels are, no doubt, transmitted along the blood stream, which quite easily conducts these sounds from the closing of the semilunar valves of the aorta. In the nearest to the heart vessels, if they are intact, we hear the systolic tone after the closing of the valves; and in case they are damaged and inadequate, this tone becomes a murmur both in the aorta and in the vessels, for instance in the jugular and in others. Both the tone and the murmur are considered as conducted and not as local. Below the sleeve you cannot hear any sounds when the sleeve compresses the upper arm, probably due to the complete constriction of the brachial artery. In experiments on animals you did not hear anything even when the first drops of blood began to appear from a cut strip of artery with the diminished pressure in the sleeve. The sounds, the murmurs, and then again the sounds you perceive as soon as the flow of the blood begins, so to speak, to become pronounced, i.e., when the blood wave becomes so large that it becomes capable to conduct those sounds which originate in the heart. Your assumption of a local origin of the sounds in the vessels presupposes, one must say, active forces. Apart from the smooth musculature, we don't know of any active force in the blood vessels. And there is too little, or even complete absence, of it in such a vessel as the brachial artery to ascribe to it the origin of sounds in the vessel. Secondly, the time of development of sounds in your experiments coincides with the diastolic of the vessel, and such a state must be regarded as passive and not active. Besides, the blood pressure, by the fluctuations of which you are attempting to explain the reasons for the sounds, is in itself a complex conception. Apart from a certain tension of the blood vessels, blood pressure and its fluctuations in either direction is produced by the energy, by the force of the heart contractions. In view of the above, it seems that, even if there were any foundation for a discussion of the local origin of sounds in the blood vessels, it would still be impossible to deny their

origin in the heart. For the present, I repeat, this is their only source.

The Speaker: First of all, I must say that the sound-tone in this instance is nothing else than the same compression murmur, however of such a short span that it is perceived by the ear as a sound-tone; indeed, the squeezing through of a minimal part of the pulse wave takes place in such a short interval of time (a fraction of 1 second) that it would be amazing if such a forcing would produce a murmur. But I also have reason to assume that the separation of the walls of the constricted vessel also takes part in the production of the sound-tones. Should we allow that the tones originate in the heart and are conducted, then the most favorable conditions for the transmission of these sound-tones should be the absence of any pressure on the pulse wave, i.e., listening to an artery which is not compressed, we should hear the sound-tones; however, under normal conditions this is not observed. Finally, the complete disappearance of the sounds with the complete constriction of the opening in the vessel also speaks against the fact that the sounds are transmitted instead of being of local origin.

Dr. I. P. Shapovalenko: The occurrence of murmurs and sounds under the gradual compression of an artery with a stethoscope has long been known. In your experiment, there was a gradual opening of the compressed artery and the sound phenomena, naturally, occurred in the reverse order, and there was noticed also a weak sound following the appearance of the murmur. Judging from your experiments on a dog, the first sound prior to the murmur appears after the passing of the first drops of blood through the compressed artery, much sooner than the detection of the pulse in the art. radialis and, therefore, with the appearance of the first sound it is possible, of course, to determine the blood pressure more accurately with the Riva-Rocci apparatus than through the pulse.

Dr. N. I. Kulbin: There was no agreement on the theories. Some are inclined to explain the origin of the sounds differently than Dr. Korotkoff. Of course, the subject cannot be considered exhausted. How applicable is your method?

The Speaker: I worked with normal vessels. Possibly in pathological cases these sounds are produced by the vessels themselves."

In issues of the same journal in the next year, 1906, under the title of, "On measuring the blood pressure with the sound method of Korotkoff," there are extensive observations by D. O. Krilov[22] on the origin

of the Korotkoff sounds. From numerous experiments, which are fully described and graphically shown, Krilov concluded that the sounds were produced by the fluctuating or centrifugal movement of the blood particles and the simultaneous vibration of the wall of the vessel. In considering the conditions under which these phenomena arose, he discussed but could provide no definite knowledge on the speed of movement of the blood. He described all the influences which affect this speed, namely, the passage of the pulse wave, the degree of vessel compression, the rate of flow and the volume of blood passing through the place of constriction, the height of the pulse wave, the pressure in the vessel, the condition of the walls, and the caliber of the vessel and, to some degree, the specific gravity of the blood. In view of the different combinations of these factors and the variation in their effects, he considered that they are responsible for the variety of sound phenomena observed. All attempts, he stated, to estimate the normal speed of the blood flow were futile; if the Korotkoff method did not permit the measurement of the speed of the blood stream, it had at least made it possible to estimate the fluctuations of this speed, which had diagnostic and prognostic value.

The Korotkoff technique became rapidly accepted and gradually widely used. Impetus to its widespread use came from the experiments of physiologists, from the actual practice and precepts of able clinicians such as Janeway, from instruction in medical schools, and from the requirements of insurance companies. Though considerable study of the last several years has been given to the pathological state of the blood pressure, and though various reports have again been made on the interpretation of the various sounds, especially the diastolic reading, the original remarks of Korotkoff and his colleagues remain tenable, a testimony to the high caliber of their physiological thinking.

Clinical sphygmomanometry, now available in general medicine, became the source of two important contributions to medicine. It increased gradually the knowledge of the state of the blood pressure in health and disease. More importantly, one may believe, it facilitated the general spread of physiological concepts; it helped to develop the appreciation of the historical course of disease by focussing attention on disturbance in function rather than in morphology; and, along with clinical thermometry, it led to more precise and accurate thinking in clinical medicine.

REFERENCES

1. Janeway, T. C. *The clinical study of blood pressure.* New York, Appleton, 1904.
2. Major, R. H. The history of taking the blood pressure. *Ann. M. Hist.* 1930, *2:*47.
3. Hales, S. *Statical essays: containing haemastaticks.* London, W. Innys, R. Manley et al, 1733, v. *2.*
4. Poiseuille, J. L. M. *Recherches sur la force du coeur aortique.* Paris, University Thesis, 1828, p. 23.
5. Ludwig, C. Beiträge zur Kenntniss des Einflusses der Respirationsbewegungen auf den Blutlauf im Aortensysteme, *Arch. f. Anat., Physiol. u. wissensch. Med.,* 1847, *6:*242.
6. Vierordt, K. *Die Lehre vom Arterienpuls in gesunden und kranken Zuständen.* Braunschweig, F. Vieweg u. Sohn, 1855.
7. Brim, C. J. The story of blood-pressure, *M. Life,* 1930, *37:*60.
8. Marey, E. J. Pression et vitesse du sang. In his: *Physiologie expérimentale,* Paris, G. Masson, 1876, v. *2,* p. 307.
9. von Basch, S. Ueber die Messung des Blutdrucks am Menschen, *Ztschr. f. klin. Med.,* 1881, *2:*79.
10. Marey, E. J. Nouvelles recherches sur la mesure manométrique de la pression du sang chez l'homme. In his: *Physiologie expérimentale,* Paris, G. Masson, 1878-79, v. *4,* p. 253.
11. Potain, C. Du sphygmomanomètre et de la mèsure de la pression artérielle chez l'homme, *Arch. de physiol. norm. et path.,* 1889, *1:*556; Détermination expérimentale de la valuer du sphygmomanomètre, *ibid.,* 1890, *2:*300; and Faits nouveaux relatif à la détermination expérimentale de la valeur du sphygmomanomètre, *ibid.,* 1890, *2:*681.
12. Mosso, A. Sphygmomanomètre pour mesurer la pression du sang chez l'homme, *Arch. ital. de biol.,* 1895, *23:*177.
13. Hürthle, K. Ueber eine Methode zur Registrirung des arteriellen Blutdrucks beim Menschen, *Deutsche med. Wchnschr.,* 1896, *22:*574.
14. Riva-Rocci, S. Un nuovo sfigmomanometro, *Gazz. med. di Torino,* 1896, *47:*981; 1001.
15. von Recklinghausen, H. Ueber Blutdruckmessung beim Menschen, *Arch. f. exper. Path. u. Pharmakol.,* 1901, *46:*78.
16. Stanton, W. B. A practical clinical method for determining blood pressure in man, with a discussion of the methods heretofore employed, *Univ. Penn. M. Bull.,* 1902-03, *15:*466.
17. Erlanger, J. A study of the errors involved in the determination of the blood-pressure in man, together with a demonstration of the improvements in the sphygmomanometer suggested thereby, *Am. J. Physiol.,* 1903-4, *10:*xiv; and A new instrument for determining the minimum and maximum blood-pressures in man. *Johns Hopkins Hosp. Rep.,* 1904, *12:*53.
18. Erlanger, J. and Hooker, D. R. An experimental study of blood-pressure and of pulse-pressure in man. *Johns Hopkins Hosp. Rep.,* 1903-4, *12:*145.
19. Hill, L. and Barnard, S. A simple and accurate form of sphygmometer or arterial pressure gauge contrived for clinical use, *Brit. M. J.,* 1897, *2:*904.
20. Potain, C. *La pression artérielle de l'homme a l'état normal et pathologique.* Paris, Masson, 1902.
21. Korotkoff, N. S. On methods of studying blood pressure, *Bull. Imperial Mil. Med. Acad.* (St. Petersburg), 1905, *11:*365.
22. Krilov, D. O. On measuring the blood pressure by the sound method of Dr. N. S. Korotkoff, *Bull. Imperial Mil. Med. Acad.* (St. Petersburg), 1906, *13:*113; 221.

RECENT ACCESSIONS TO THE LIBRARY

"Possession does not imply approval"

American Public Health Association. Standard Methods Committee on Diagnostic Procedures and Reagents. *Diagnostic procedures and reagents.*
N. Y., Amer. Pub. Health Assoc., 1941, 352 p.

Anderson, W. *The early treatment of war wounds.*
London, Milford, 1941, 96 p.

Andes, J. E. & Eaton, A. G. *Synopsis of applied pathological chemistry.*
St. Louis, Mosby, 1941, 428 p.

Blacklock, D. B. & Southwell, T. *A guide to human parasitology.* 4. ed.
Balt., Williams, 1940, 259 p.

Bogert, L. J. *Dietetics simplified, the use of foods in health and disease.* 2. ed.
N. Y., Macmillan, [1941], 742 p.

Bradford, F. K. & Spurling, R. G. *The intervertebral disc.*
Springfield, Ill., Thomas, [1941], 158 p.

Brekhus, P. J. *Your teeth; their past, present, and probable future.*
Minneapolis, Univ. of Minn. Press, [1941], 255 p.

Burpee, R. H. *Seven quickly administered tests of physical capacity.*
N. Y., Teachers College, Columbia Univ., 1940, 151 p.

Cahn, L. R. *Pathology of the oral cavity.*
Balt., Williams, 1941, 240 p.

Cameron, T. W. M. *The principles of parasite control.*
Gardenvale, Que., National Business Publications, 1940, 48 p.

Child, C. M. *Patterns and problems of development.*
Chic., Univ. of Chic. Press, [1941], 811 p.

Cipes, L. R. *Prescription writing and formulary for dentists.*
Brooklyn, Dental Items of Interest Pub. Co., 1941, 233 p.

Crampton, C. W. G. *Start today; your guide to physical fitness.*
N. Y., Barnes, [1941], 224 p.

Drinker, C. K. & Yoffey, J. M. *Lymphatics, lymph, and lymphoid tissue; their physiological and clinical significance.*
Cambridge, Mass., Harvard Univ. Press, 1941, 406 p.

Eliason, E. L. *First aid in emergencies.* 10 ed.
Phil., Lippincott, [1941], 260 p.

Elsberg, C. A. *Surgical diseases of the spinal cord, membranes, and nerve roots.*
[N. Y.,] Hoeber, [1941], 598 p.

English, W. F. *Anatomy and allied sciences for lawyers.*
Buffalo, Dennis, [1941], 464 p.

Gesell, A. L. & Amatruda, C. S. *Developmental diagnosis, normal and abnormal child development.*
N. Y., Hoeber, [1941], 447 p.

Gradwohl School of Laboratory Technique, St. Louis, Mo. *Examination questions in laboratory methods.*
St. Louis, Gradwohl School of Laboratory Technique, 1941, v. p.

Groves, E. R. *Marriage.* Rev. ed.
N. Y., Holt, [1941], 671 p.

Halpert, B. *Necropsy.*
St. Louis, Mosby, 1941, 75 p.

Hammett, J. E. *Abdominal surgery.*
N. Y., Oxford Univ. Press, 1941, 356 p.

Harley, G. W. *Native African medicine.*
Cambridge, Mass., Harvard Univ. Press, 1941, 294 p.

Hinsie, L. E. *Visual outline of psychiatry.*
N. Y., Oxford Univ. Press, 1941, 109 p.

Hoagland, H. W. *My life.*
[Pomona, Cal.], priv. print., 1940, 128 p.

Hull, T. G. *Diseases transmitted from animals to man.* 2. ed.
Springfield, Ill., Thomas, 1941, 403 p.

Husa, W. J. *Pharmaceutical dispensing.* 2. ed.
Iowa City, Husa, 1941, 794 p.

Katz, L. N. *Electrocardiography.*
Phil., Lea, 1941, 580 p.

Katz, L. N. *Exercises in electrocardiographic interpretation.*
Phil., Lea, 1941, 222 p.

Kessler, H. H. *Accidental injuries.* 2. ed.
Phil., Lea, 1941, 803 p.

Klinik (Die) und die Behandlung der örtlichen Erfrierungen. Hrsg. unter der Redaktion von Hans Debrunner.
Bern, Huber, [1941], 128 p.

Kolmer, J. A. & Tuft, L. *Clinical immunology, biotherapy and chemotherapy.*
Phil., Saunders, 1941, 941 p.

Krogman, W. M. *A bibliography of human morphology,* 1914-1939.
Chic., Univ. of Chic. Press, [1941], 385 p.

Lester, C. W. *Thoracic surgery.*
N. Y., Oxford Univ. Press, 1941, 141 p.

Lewis, K. M. *Fractures and dislocations.*
N. Y., Oxford Univ. Press, 1941, 217 p.

McCulloch, M. C. *Fearless advocate of the right; the life of Francis Julius LeMoyne.*
Boston, Christopher, [1941], 279 p.

McNeill, C. *Roentgen technique.* 2. ed.
Springfield, Ill., Thomas, 1941, 329 p.

McQuillan, A. S. *Surgery of head and neck.*
N. Y., Oxford Univ. Press, 1941, 138 p.

Methodist Episcopal Hospital, Brooklyn. Training School for Nurses. *Procedure book.* 4. ed.
Brooklyn, [Methodist Episcopal Hospital], 1941, 424 p.

Morgenthaler, W. & Forel, O. L. *Manuel de psychiatrie à l'usage du personnel infirmier.* 2. éd.
Berne, Huber, 1940, 240 p.

National Foundation for Infantile Paralysis. *Infantile paralysis; a symposium delivered at Vanderbilt University, April, 1941.*
N. Y., The Foundation, [1941], 239 p.

New York (State). Legislature. Commission to Formulate a Long Range State Health Program. *Medical care in New York State, 1939.*
Albany, Lyon, 1940, 492 p.

New York (State). Legislature. Commission to Formulate a Long Range State Health Program. *Special report on the State-wide health preparedness conference.*
Albany, Fort Orange Press, 1941, 194 p.

New York (State). Trichinosis Commission. *Meat for millions: report.*
Albany, Fort Orange Press, 1941, 282 p.

Nolan, R. A. *The V-plan for controlling venereal diseases in military commands.*
[San Diego, Cal., V-plan Pub. Co., 1941], 79 p.

Nonidez, J. F. *Histology and embryology.*
N. Y., Oxford Univ. Press., 1941, 199 p.

Operative surgery: edited by F. W. Bancroft.
N. Y., Appleton-Century, [1941], 1102 p.

Oribasius Sardianus. *Oribasius Latinus;* hrsg. von Henning Mørland.
Osloae, Brøgger, 1940, v. 1.

O'Rourke, J. T. & Miner, L. M. S. *Dental education in the United States.*
Phil., Saunders, 1941, 367 p.

Pardo Castelló, V. *Diseases of the nails.* 2. ed.
Springfield, Ill., Thomas, 1941, 193 p.

Pollock, H. M. *Mental disease and social welfare.*
Utica, N. Y., State Hospitals Press, 1941, 237 p.

Ritter Dental Manufacturing Co. *Instruction book embodying the use of the modern dental X-ray unit.* [6. ed.]
Rochester, Ritter Dental Mfg. Co., 1940, 127 p.

Rowe, A. H. *Elimination diets and the patient's allergies.*
Phil., Lea, [1941], 264 p.

Schwing, G. *Ein Weg zur Seele des Geisteskranken.*
Zürich, Rascher, 1940, 135 p.

Segal, J. *Diseases of the respiratory tract.*
N. Y., Oxford Univ. Press, 1941, 172 p.

Thannhauser, S. J. *Lipidoses: diseases of the cellular lipid metabolism.* (Reprinted from Oxford loose-leaf medicine).
N. Y., Oxford Univ. Press, [1940], 370 p.

Therapeutics (The) of internal diseases. [Supervising editor: George Blumer].
N. Y., Appleton-Century, [1941], v. 4-5.

Thewlis, M. W. *The care of the aged.* 3. ed.
St. Louis, Mosby, 1941, 579 p.

Thomen, A. S. A. *Doctors don't believe it. Why should you?*
N. Y., Simon, 1941, 384 p.

Tournier, P. *Médecine de la personne.*

Neuchatel, Delachaux, [1940], 293 p.

Trauma and disease, edited by L. Brahdy and S. Kahn. 2. ed.
Phil., Lea, 1941, 655 p.

United States. War Department. *Records of morbidity and mortality (sick and wounded).*
Wash., U. S. Gov. Pr. Off., 1940, 168 p.

Valentine, W. L. *Experimental foundations of general psychology.* Rev. ed.
N. Y., Farrar, [1941], 432 p.

Williams, J. F. *Personal hygiene applied.* 7. ed.
Phil., Saunders, 1941, 529 p.

Williamson, H. C. & Schaefer, G. *Obstetrics.*
N. Y., Oxford Univ. Press, 1941, 113 p.

Woodman, A. G. *Food analysis.* 4. ed.
N. Y., McGraw-Hill, 1941, 607 p.

Zondek, B. *Clinical and experimental investigations on the genital functions and their hormonal regulation.*
Balt., Williams, 1941, 264 p.